United States Department of Agriculture

Natural Resources Conservation Service

P.O. Box 2890
Washington, D.C.
20013

MAR 0 8 1996

NATIONAL SOIL TAXONOMY HANDBOOK
430-VI
ISSUE NO. 18

Purpose. To distribute current amendments to Soil Taxonomy, Agriculture Handbook 436.

Effective Date. These amendments and revisions are effective when received.

Filing Instructions. File this copy of the changes in the 3-ring binder with Issues Nos. 1 through 17. It is suggested that you keep this binder with the Soil Taxonomy volume for easy reference.

Remove pages iii through x and replace with iii through xiv dated March 1996. File pages 615-663 to 615-731 following page 615-662.

Supplementation. States may not supplement the handbook.

Richard L. Duesterhaus

RICHARD L. DUESTERHAUS

Attachments

DIST: NSTH

Part 615 - Amendments to Soil Taxonomy

Section

Section

Index to pages of Soil Taxonomy

Section	Page
615.110	372-373
615.111	50, 383, 384, no page number (NSTH page 615-206)
615.112	385 (NSTH page 615-207)
615.113	383, 388, 389
615.114	No page numbers
615.115	41, 45, 46, 47, 51, 85, 88, 95, 96, 109, 137, 139, 140, 142, 143, 144, 145, 146, 155, 180, 190, 194, 197, 201, 205, 209, 227, 228, 257, 285, 298, 301, 302, 304, 305, 308, 309, 312, 315, 318, 321, 384
615.116	315 (NSTH 615.62 p. 615-347) (changed NSTH 615.90 P. 615-545)
615.117	384 (NSTH 615.68, p. 615-396)
615.118	No page number (NSTH 615.62, p. 615-209) (615.90, p. 615-516)., (NSTH 615.89, p. 615-428), (NSTH 615.89, p. 615-429), (NSTH 615.62, p. 615-215), (NSTH 615.62, p. 615-215), (615.90, p. 615-516), (NSTH 615.62, p. 615-216), (615.90, p. 615-516), (NSTH 615.62, p. 615-218), (NSTH 615.62, p. 615-218), (NSTH 615.62, p. 615-219) (NSTH 615.89, p. 615-438), (NSTH 615.89, p. 615-438), (NSTH 615.62, p. 615-222), (NSTH 615.89, p. 615-439), (NSTH 615.62, p. 615-236), (NSTH 615.89, p. 615-446), (NSTH 615.62, p. 615-237), (NSTH 615.89, p. 615-446), (NSTH 615.89, p. 615-447), (NSTH 615.62, p. 615-239), (NSTH 615.89, p. 615-447), (NSTH 615.62, p. 615-262), (NSTH 615.62, p. 615-263), (NSTH 615.89, p. 615-461), (NSTH 615.62, p. 615-267), (NSTH 615.62, p. 615-268), (NSTH 615.62, p. 615-268), (NSTH 615.62, p. 615-269), (NSTH 615.89, p. 615-467), (NSTH 615.89, p. 615-467), (NSTH 615.62, p. 615-271), (NSTH 615.62, p. 615-273), (NSTH 615.62, p. 615-274), (NSTH 615.62, p. 615-275), (NSTH 615.89, p. 615-469), (NSTH 615.62, p. 615-276), (NSTH 615.62, p. 615-290), (NSTH 615.89, p. 615-475), (NSTH 615.89, p. 615-476), (NSTH 615.62, p. 615-291), (NSTH 615.62, p. 615-294), (NSTH 615.62, p. 615-294), (NSTH 615.62, p. 615-295), (NSTH 615.62, p. 615-296), (NSTH 615.89, p. 615-480), (NSTH 615.89, p. 615-480), (NSTH 615.89, p. 615-480), (NSTH 615.89, p. 615-481), (NSTH 615.62, p. 615-298), (NSTH 615.89, p. 615-481), (NSTH 615.62, p. 615-300), [illegible]

Section Page

[redacted]

615.89 34, 36 (NSTH page 615-387), 42, 47, 48,50-51, 54, 55, 63, 77, 79, 83, 85, 89,90, 93, 95, 96-373 (NSTH pages 615-179/384)

615.90 48, 51, 75, 76, 92 (NSTH page 615-179), 95-96 (NSTH page 615-179), 110-382 (NSTH pages 615-209/386)

615.91 29-32, 63, 92, 96 NSTH page 615-179), no page number (NSTH pages 615-186, 188, 200, 203), 155, 156 (NSTH page 615-203), 179, 180 (NSTH page 615-204), 186 (NSTH page 615-266), 202

Section	Page
615.136	86
615.137	96, 109, 218, and 251, (NSTH 615.45 p 615-123), (NSTH 615.60 p. 615-176, 615-185, 615-186, 615-192, 615-187, 615-195, 615-196, 615-197, 615-199, and 615-206), (NSTH 615.62 p. 615-300), (NSTH 615.89 p. 615-427, 615-449, and 615-508), (NSTH 615.90 p. 615-564), (NSTH 615.91 p. 615-587), (NSTH 615.100 p. 615-597)
615.138	2
615.139	49
615.140	15, 36, 48, 49, 53, 54, 57, 65, 68, 69, 91, 95, 179, 211, 271, 323, 333, 349, 375, NSTH 615.89 p. 615-424, 615.115 p. 615-606, NSTH 615.115 p. 615-607, NSTH 615.115 p. 615-609,
615.141	91, NSTH 615.115, p. 615-609, NSTH 615.115, p. 615-611
615.142	95, 96, 299, 307, 311, 320, NSTH 615.62, p. 615-305, NSTH 615.79, p. 615-402, NSTH 615.62, p. 615-323, NSTH 615.62, p. 615-324, NSTH 615.129, p., 615-655, NSTH 615.62, p., 615-325, NSTH 615.62, p. 615-342, NSTH 615.62, p. 615-343, NSTH 615.62, p. 615-344, NSTH 615.62, p. 615-345, NSTH 615.62, p. 615-349, NSTH 615.62, p. 615-350, NSTH 615.62, p. 615-352, NSTH 615.91, p. 615-572, NSTH 615.45, p. 615-112

Section	Page
	(NSTH 615.62, p. 615-323), (NSTH 615.62, p. 615-328), (NSTH 615.90 p. 615-537), (NSTH 615.62, p. 615-329), (NSTH 615.90, p. 615-538), (NSTH 615.62, p. 615-332), (NSTH 615.62, p. 615-332), (NSTH 615.62, p. 615-338), (NSTH 615.106, p. 615-601), (NSTH 615.62, p. 615-344), (NSTH 615.90, p. 615-544), (NSTH 615.62, p. 615-344), (NSTH 615.62, p. 615-346), (NSTH 615.90, p. 615-545), (NSTH 615.62, p. 615-347), (NSTH 615.62, p. 615 348), (NSTH 615.62, p. 615-348)
615.119	202, (NSTH 615.62 p. 615-277), 205, (NSTH 615.62 p. 615-278), 208, (NSTH 615.62 p. 615-280 and 615-281), 314, (NSTH 615.62 p. 615-346)
615.120	386, (NSTH 615.60, p. 615-207) (revised NSTH 615.112 p. 615-605)
615.121	183 and 186, (NSTH 615.89 p. 615-462, 615-463, 615-464, 615-476 615-477 and 615-478), and (NSTH 615.62 p. 615-264, 615-265, and 615-266)
615.122	202, 204, 206, 207, and 208, (NSTH 615.62 p. 615-277,615-278, 615-279, and 615-280), (NSTH 615.72 p. 615-397 and 615-398)
615.123	218, 215, 216, 217, 220, 221, 222, 223, 224, 225, and 226, (NSTH 615.62 p. 615-281, 615-282, 615-283, 615-284, 615-285, 615-286, 615-287, 615-288, and 615-289)
615.124	48, (NSTH 615.89 p. 615-425)
615.125	No page number, (NSTH 615.89 p. 615-429)
615.126	110, 130, 139, 143, 283, (NSTH 615.61 p. 615-209, 615-222), (NSTH 615.90 p. 615-517, 615-518, 615-519, 615-535, 615-537) (NSTH 615.89 pp. 615-489 and 615-490)
615.127	No page number (NSTH 615.60 p. 615-188, 615-199, and

Section	Page
615.157	NSTH 615.62, p. 615-317, NSTH 615.90 p. 615-537, NSTH 615.102 p. 615-600, NSTH 615.127 p. 615-653, NSTH 615.62, p. 615-318, NSTH 615.62, p. 615-323 and 324, NSTH 615.62, p. 615-325 NSTH 615.62, p. 615-328, NSTH 615.89, p. 615-493.

615.138 Definition of Buried Soils

Page 2, column 2. Replace section on buried soils with the following:

"BURIED SOILS

A soil is defined as a buried soil if it is covered with a surface mantle of new soil material that is either 50 cm or more thick, or is 30 to 50 cm thick and has a thickness that equals at least half the total thickness of the named diagnostic horizons that are preserved in the buried soil. A surface mantle of new material less than 30 cm thick is not considered in the taxonomy, except for the soil temperature, soil moisture (including aquic conditions), and any andic or vitrandic properties. The surface mantle is considered in establishing a phase if it affects the use of the soil.

A surface mantle of new material, as defined here, is largely unaltered, at least in the lower part. It may have a diagnostic surface horizon (epipedon) and/or a cambic horizon, but has no other diagnostic subsurface horizons, all defined later. However, there remains a layer 7.5 cm or more thick that fails the requirements for all diagnostic horizons, as defined later, overlying a horizon sequence that can be clearly identified as the solum of a buried soil in at least half of each pedon. This layer must also fail color and structure requirements of the cambic horizon if sandy. The recognition of a surface mantle should not be based only on studies of associated soils."

615.139 Definition of Ortstein

Page 49 column 2, following "Organic soil materials" add the following:

"Ortstein

Ortstein is a cemented horizon that consists of spodic materials.

Ortstein has one of the following orientations:

1. As a relatively horizontal layer. This type of orientation tends to be root restrictive and occurs primarily in Aquods.

3. Is 25 mm or more thick."

615.140 Paralithic, and densic materials and contacts and pararock fragments

Page 15, column 2, last line; Rewrite item 5. and 5.a. as follows:

"5. After mixing the upper 18 cm of the mineral soil, or the whole mineral soil if its depth to a densic, lithic, or paralithic contact, a petrocalcic horizon, or a duripan (all defined below) is less than 18 cm, the thickness of the epipedon is as follows:

a. 10 cm or more if the epipedon is directly above a densic, lithic, or paralithic contact, a petrocalcic horizon, or a duripan; or"

NSTH 615.79, before "a lithic,"; Add "a densic" in the following places:

P. 615-402, column 2, line 6; P. 615-402, column 2, line 18; P. 615-403 column 1, line 8; P. 615-403 column 1, line 12

NSTH 615.91, p 615-571, Identification, line 4; Replace "a *lithic* or *paralithic*" with "a densic, lithic, or paralithic"

NSTH 615.91, p 615-572, column 1, line 20; Replace "lithic" with "densic, lithic,"

NSTH 615.91, p 615-572, column 1, line 43, before "petroferric"; Add "densic, "

Page 53, column 2, line 36; Replace entire paragraph with the following:

"If 7.5 cm of water moistens the soil to a densic, lithic, paralithic, or petroferric contact or to a petrocalcic or petrogypsic horizon or a duripan, the contact or the upper boundary of the cemented horizon constitutes the lower boundary of the soil moisture control section. If a soil is moistened to one of these contacts or horizons by 2.5 cm of water, the soil moisture control section is the contact or boundary itself. The control section of such a soil is considered moist if the contact or upper boundary of the cemented horizon has a thin film of water. If that upper boundary is dry,

Densic materials have at their upper boundary a *densic contact* if the densic material has no cracks or the spacing of cracks that roots can enter is 10 cm or more. Densic materials can be used to differentiate soil series if the materials are within the series control section (defined below)."

Page 49, delete entire section "paralithic contact", and insert the following:

"**Paralithic contact**
A paralithic (lithic like) contact is a contact between soil and paralithic materials (defined below) where the paralithic materials have no cracks or the spacing of cracks that roots can enter is 10 cm or more. It differs from the *densic contact* and the *lithic contact* in that the material forming a densic contact slakes when air dried fragments are submerged in water and the material forming a lithic contact is in a strongly cemented or more cemented rupture resistance class (rock fragments).

Page 69, Replace "lithic" with "densic, lithic," in the following places: column 1, line 17; column 2, line 2;

Page 91, Replace "lithic" with "densic, lithic," in the following places:
Item A.1.; Item A.2.a.; Item A.2.c.; Item B.3.c.(1); Item B.3.d.(2)(a); Item B.3.d.(2)(b); Item C.1.; C.2.; E.2.; G.1.a.(2); G.1.b.(3); G.2.b.(3); H.2.

Page 95, Chapter 8 Alfisols; Replace "lithic" with "densic, lithic," in the following places:
Definition (of Alfisols) items; 1.a.(2), (2 places); 1.b.; 3.c.; 4.b.; 7.; Limits between Alfisols and other orders items; 1.; 5.b.; 8.b.(1)(c); 8.b.(2)(c); 8.b.(3)(b); 9.b.; All vertic and vertic combination subgroups; All ultic and ultic combination subgroups; All definitions of typic subgroups (exclusion of ultic, vertic, and combination subgroups; Item IEG.1.; Item IEI.1.; Definition of Hapludalfs item 4.; Descriptions of ultic, psammentic,

Definition of Histosols items 1.a., 1.b., and 3.; Items AA.1. and AB.2.; Definition of Fibrists items 1.a. and 2.; Item ABA.; Definition of Borofibrists item 3.; Definition of Cryofibrists item 2.; Definition of Medifibrists items 1. and 2.; Page 216, column 1, line 2; Definition of Sphagnofibrists item 1.; Definition of Tropofibrists items 1. and 2.; Definition of Folists items 1.a. and 2.; Definition of Hemists item 1.; Definition of Medihemists item 1.; Definition of Tropohemists item 1.; Definition of Saprists item 1.; Definition of Medisaprists item 1.; Definition of Troposaprists item 1.

Page 227, Chapter 13 Inceptisols; Replace "lithic" with "densic, lithic," in the following places: Definition of Inceptisols items 1.e.(2) and 1.g.; Limits between Inceptisols and other orders, items 2. and 10.b.; Items JA.1. and JAG.; Definition of Aquepts item 1.; All alfic, calcic, cumulic, fluventic, dystric, oxic, rendollic, ultic, vertic, and combination subgroups using one of these subgroups and in the descriptions of the typic subgroups of all great groups using these subgroups; Definition of Ochrepts item 2.; Items JCA.2., JCC.2., and JCD., Definition of Dystrochrepts item 2.; Definition of Eutropepts item 1.; Definition of Humitropepts item 5. and 8.b.; Definition of Umbrepts item 2.

Page 271, Chapter 14 Mollisols; Replace "lithic" with "densic, lithic," in the following places (unless otherwise noted): Definition of Mollisols; Items 1., 2., 3., and 4.b.; Limits between Mollisols and other orders, items 1.a., 2., and 10.b.; Item HB.; All cryic, cumulic, fluventic, oxic, pachic, ultic, and vertic subgroups and combination great groups using these subgroups, and in the descriptions of the typic subgroups of all great groups using these subgroups; Definition of Aquolls; line 2; Typic Duraquolls, item 2.b. delete "lithic or paralithic contact or"; Item HEE.2.; Definition of Aquolls, line 2; Typic Vermiborolls, item 2.; Footnote 1., change "lithic" to "densic, lithic, or paralithic"; Item HGA.2.a.; Item HGD.2., change "lithic" to "densic, lithic, or paralithic"; Definition of Hapludolls, line 2; Definition of Paleudolls; Item HGAA. (Vertic Paleudolls) and in item 3.b. of the definition of Typic Paleudolls, change "lithic or paralithic contact" to "petrocalcic horizon"; Definition of Vermudolls; Item 2.; Items HFC.2.a., HFC.2.b., and HFF.2., change "lithic" to "densic, lithic, or paralithic"; Definition of Argiustolls; Item 1.b.; Definition of Paleustolls; Item 1.a. and 1.b.; Definition of Vermustolls; Item 2.; Item HDC.2.b.; Definition of Argixerolls; Item 2.b.; Definition of Palexerolls; Item 1.b.

Page 323, Chapter 15 Oxisols; Replace "lithic" with "densic, lithic," in the definition of Oxisols, item 3.

Page 333, Chapter 16 Spodosols; Replace "lithic" with "densic, lithic," in the definition of Spodosols, items 3.c.(1), 3.d.(2)(a), and 3.d.(2)(b).

Page 349, Chapter 17 Ultisols; Replace "lithic" with "densic, lithic," in the following places: Definition of Ultisols, items 1.a.(1)(c), 1.a.(2) 1.b.(2), 3., and 4.b.; Limits between Ultisols and other orders, items 1.a.(1)(c), 1.a.(2), 1.a.(3)(b), 2., 3.a., 3.b.(2), 6.a., 6.b.(2) and 9.b.; All vertic subgroups and combination "vertic" subgroups, and in the descriptions of the typic subgroups of all great groups using these subgroups; Definition of Kandiaquults, item 2. Items GBC.1. and GBE.1.; Definition of Kandihumults, item 2.; Items GCC.1. and GCE.1.; Definition of Kandiudults, item 2.; Definition of Paleudults, line 1.; Items GDB.1. and GDD.1.; Definition of Kandiustults, item 2.; Item GEA.1.; Definition of Palexerults, item 1.;

Page 375, Chapter 18 Vertisols; Replace "lithic" with "densic, lithic," in the following places: Definition of Vertisols, items 1. and 4.b. All leptic subgroups and combination "leptic" subgroups, and in the descriptions of the typic subgroups of all great groups using these subgroups.

615.141 Identification of the Taxonomic Class of a Soil.

Page 91, Replace chapter 7 *Identification of the Taxonomic Class of a Soil* from the beginning to "KEY TO SOIL ORDERS" with the following:

"Chapter 7

IDENTIFICATION OF THE TAXONOMIC CLASS OF A SOIL

The taxonomic class of a specific soil can be determined by using the keys that follow in this and other chapters. It is assumed that the reader is familiar with the meanings of the terms used for describing soils that are given in appendix I, II, and III and with the definitions of diagnostic horizons and properties that are given in chapters 3 and 4. The index indicates the pages (boldface type) on which definitions of terms are given.

Conventional rounding conventions should be used to determine numerical values.

Soil colors, (hue, value, and chroma) are used in many of the criteria that follow. Soil colors typically change value and some change hue and chroma depending on the water state. In many of the criteria of the keys, the water state is specified. If no water state is specified, the soil is considered to meet the criterion if it meets the criterion when moist or dry or both moist and dry.

All of the keys in this taxonomy are designed in such a way that the user can determine the correct classification of a soil by going through the key systematically. The user must start at the beginning of the *Key to soil orders* and eliminate, one by one, all classes which include criteria that do not fit the soil in question. The soil belongs to the first class listed for which it meets all the required criteria.

In classifying a specific soil, the user of Soil Taxonomy begins by checking through the *Key to soil orders* to determine the name of the first order which, according to the criteria listed, includes the soil in question. The next step is to go to the page indicated to find the *Key to suborders* of that particular order. Then systematically go through the key to identify the suborder that includes the soil, i.e., the first in the list for which it meets all the required criteria. The same procedure is used to find the soil's great group class in the *Key to great groups* of the identified suborder. Likewise, going through the *Key to subgroups* of that great group, the user selects as the correct subgroup name the name of the first taxon for which the soil meets all of the required criteria.

The family level is determined, in a similar manner, after the subgroup has been determined. Chapter 19 can be used as one would use other keys in this taxonomy to

determine which components are part of the family name. However, the family typically has more than one component, and therefore the entire chapter must be used. The keys to control sections for classes used as components of a family name must be used to determine the control section before using the keys to classes.

The descriptions and definitions of individual soil series are not included in this text. The definition of the series, the control section, and examples of the application are given in Chapter 19. The classification of the series and the list of families and their included series for the soils of the 50 states, Puerto Rico, and the Virgin Islands are given in another publication (Soil Series of the United States, Puerto Rico, and the Virgin Islands: Their Taxonomic Classification, 1990). That publication does not include the descriptions or definitions of the series, but descriptions of

Page 96, column 2, line 30; Change "distribution" to "class"

NSTH 615.62, p. 615-305, replace item JDEO. (Calcixerollic Xerochrepts, renumbered to JDFP.) with the following:

"JDFP. Other Xerochrepts that have a calcic horizon or identifiable secondary carbonates, within one of the following particle-size class and depth combinations:

1. A sandy or sandy-skeletal particle-size class and within 150 cm of the mineral soil surface; *or*

2. A clayey, clayey-skeletal, fine, of very fine particle-size class and within 90 cm of the mineral soil surface; *or*

3. Any other particle-size class and within 110 cm of the mineral soil

- skeletal particle-size class between 40 and 50 cm from the mineral soil surface.
Pachic Haploborolls"

NSTH 615.129_ p.. 615-655. item: HEGH.: Replace item

or do not have a calcic horizon within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

Calcic Argixerolls"

NSTH 615.62, p. 615-345, column 2, item 3.; Replace with the following:

"3. Do not have a calcic horizon or identifiable secondary carbonates within one of the following particle-size class (by weighted average in the particle-size control section) and depth combmations:

a. Sandy or sandy-skeletal and within 150 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 90 cm of the mineral soil surface; *or*

c. Any other class and within 110 cm of the mineral soil surface;"

Calcic Haploxerolls"

NSTH 615.62, p. 615-350, column 2, item 2.; Replace with the following:

"2. Do not have a calcic horizon or identifiable secondary carbonates within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

a. Sandy or sandy-skeletal and within 150 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 90 cm of the mineral soil surface; *or*"

c. Any other class and within 110 cm of

NSTH 615.62, p. 615-349, item HDFI. (Calcic Pachic Haploxerolls, renumbered to HDFJ.); Replace item 2. with the following:

"2. A calcic horizon or identifiable secondary

Page 320, column 2, item 1.b.; Replace "A particle-size class in the upper part that is clayey" with "Thirty-five percent or more clay in the upper part"

replacing "sandy particle size" with "sandy or sandy-skeletal particle-size class":

NSTH 615.62, p. 615-209 item IAGA.; NSTH 615.89, p. 615-428, items IAJB. and IAJC.; NSTH 615.89, p. 615-430, items IAIC. and IAID. (changed to IAIF. and IAIG.); NSTH 615.62, p. 615-210 and 211 items IAFA. and IAFB.; NSTH 615.62, p. 615-211 items IAEA. and IAEB.; NSTH 615.62, p. 615-215 items IAHB. and IAHC.; NSTH 615.62, p. 615-216 and 217 items IBED. and IBEH. (changed to IBEE. and IBEJ.); NSTH 615.62, p. 615-221 items IEDC. (changed to IEEG.); NSTH 615.62, p. 615-222 and 223 items IEKH. and IEKI. (changed to IEKL. and IEKM.); NSTH 615.62, p. 615-225 items IEGC., IEGD., IEGE., and IEGF. (changed to IEGD., IEGE., IEGF., and IEGG.); NSTH 615.62, p. 615-227 items IEIF., IEIG., IEIL., and IEIJ. (changed to IEIH., IEIL., IEIK., and IEIL.); NSTH 615.62, p. 615-228 and 229 items ICHD., ICHH., and ICHI. (changed to ICHF., ICHK., and ICHL.); NSTH 615.62, p. 615-230 items ICDA., ICDB., ICDE., and ICDF.; NSTH 615.62, p. 615-232 items ICCA., ICCB., and ICCD. (changed to ICCB., ICCC., and ICCE.); NSTH 615.62, p. 615-233 and 234 items ICFD., ICFE., ICFI., and ICFJ. (changed to ICFK., ICFE., ICFJ., and ICFL.); NSTH 615.62, p. 615-240 item IDFF., (changed to IDFG.); NSTH 615.115, p 615-612 items FEEF. and FEEG.; NSTH 615.115, p 615-615 items FEFI. and FEFJ.; NSTH 615.115, p 615-618 items FECC. and FECD.; NSTH 615.62, p. 615-300 item JDFK. (changed to JDGM.); NSTH 615.62, p. 615-314 items HBEA. and HBEB.; NSTH 615.102, p. 615-600 item HEDB.; NSTH 615.91, p. 615-579, items BABD., BABE., BABF., and BABG.; NSTH 615.91, p. 615-587 and 588, items BDDB., BDDC., BDDD., and BDDF.; NSTH 615.89, p. 615-507 items GAIA., and GAIB.; NSTH 615.89, p. 615-508 items GAHB., and GAHC.; NSTH 615.62, p. 615-366 items GADB., GADC., GADD., and GADE.; NSTH 615.62, p. 615-367 items GAFA., GAFB., GAFC., and GAFD. (changed to GAFB., GAFC., GAFD., and GAFE.); NSTH 615.62, p. 615-371 item GCBA.; NSTH 615.62, p. 615-372 items GCGE. and GCGF.; NSTH 615.62, p. 615-373 and 374, items GCCA., GCCB., GCCC., GCCD., GCCE.; GCCF., and GCCG.; NSTH 615.62, p. 615-375, items GCDB., and GCDC.; NSTH 615.62, p. 615-377, items GCED., GCEE., GCEF., GCEG., GCEH.; GCEI., and GCEJ., (changed to GCEE., GCEF., GCEG., GCEH.; GCEI., GCEJ., and GCEK.); NSTH 615.62, p. 615-379, item GDFD.; NSTH 615.62, p. 615-380, items GDBC., and GDBD.; NSTH 615.62, p. 615-381, item GDCD.; NSTH 615.62, p. 615-383, items GEBE., and GEBF.;

615.144 Changes to Aqualfs and Aeric subgroups of Aqualfs

Page 96, NSTH 615.89 p. 615-427 item HA.

b. No peds present and a chroma of 2 or more (both moist and dry); *or*

2. Hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

b. A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Glossaqualfs"

NSTH 615.62, p. 615-211, definition of Typic Glossaqualfs; Change *item 1.* to read:

"1. Have, in all horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, less than 50 percent of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations;"

NSTH 615.125, p. 615-649, change item IAJD. (Udollic Endoaqualfs) to read:

"IAJD. Other Endoaqualfs which have *both*:

1. A mollic epipedon, or an Ap horizon that meets all the requirements for a mollic epipedon except thickness, or

b. A chroma of 2 or more (both moist and dry) and no redox concentrations.

Udollic Endoaqualfs"

NSTH 615.89, p. 615-428, change item IAJD. (Aeric Endoaqualfs, changed to item IAJE.) to read:

"IAJE. Other Endoaqualfs that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

1. Hue of 7.5YR or redder; *and*

a. Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

b. No peds present and a chroma of 2 or more (both moist and dry); *or*

2. Hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

b. A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Endoaqualfs"

NSTH 615.89, p. 615-429, defmition of Typic Endoaqualfs; Change item 1. to read:

"1. Have, in all horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, less than 50 percent of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations;"

NSTH 615.126, p. 615-650, change item IAIA. and IAIB. as follows:

some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations; *and*

3. An Ap horizon or materials between the mineral soil surface and 18 cm that after mixing meet *one or more* the following colors;

a. A color value, moist, of 4 or more; *or*

b. A color value, dry, of 6 or more; *or*

c. A chroma of 4 or more.

Aeric Chromic Vertic Epiaqualfs

IAIB. Other Epiaqualfs which have *both* of the following:

1. *One or both*:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Vertic Epiaqualfs"

NSTH 615.89, p. 615-430, change items IAIE. (Aeric Umbric Epiaqualfs, changed to IAIH.), IAIF. (Udollic Epiaqualfs, changed to IAII.), and IAIG. (Aeric Epiaqualfs, changed to IAIJ.), as follows:

"IAIH. Other Epiaqualfs which have:

1. An Ap horizon that meets all the requirements for an umbric epipedon except thickness, or materials between the soil surface and a depth of 18 cm that meet these requirements after mixing; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Umbric Epiaqualfs

IAII. Other Epiaqualfs which have *both*:

1. A mollic epipedon, or an Ap horizon that meets all the requirements for a mollic epipedon except thickness, or materials between the soil surface and a depth of 18 cm that meet these requirements after mixing; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Udollic Epiaqualfs

IAIJ. Other Epiaqualfs that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

1. Hue of 7.5YR or redder; *and*

a. Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

b. No peds present and a chroma of 2 or more (both moist and dry); *or*

2. Hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

b. A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Epiaqualfs"

NSTH 615.89, p. 615-431, definition of Typic Epiaqualfs; Change item 1. to read:

"1. Have, in all horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, less than 50 percent of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations;"

NSTH 615.89, p. 615-433, change items IAED. (Aeric Umbric Kandiaqualfs) and IAEE. (Aeric Kandiaqualfs), as follows:

"IAED. Other Kandiaqualfs which have:

1. An Ap horizon that meets all the requirements for an umbric epipedon except thickness, or materials between the soil surface and a depth of 18 cm that meet these requirements after mixing; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Umbric Kandiaqualfs

IAEE. Other Kandiaqualfs which have in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

1. Hue of 7.5YR or redder; *and*

a. Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

b. No peds present and a chroma of 2 or more (both moist and dry); *or*

2. Hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

b. A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Kandiaqualfs"

NSTH 615.89, p. 615-434, definition of Typic Kandiaqualfs; Change item 1. to read:

"1. Have, in all horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, less than 50 percent of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations;"

615.145 Changing "Ustic" Boralfs to Ustalfs and adding new subgroups

Page 109, Item HB.1. "Boralfs" (changed to IB.1.). Replace item 1. with the following:

"1. A frigid temperature regime, *and neither* a xeric *nor* ustic moisture regime; *or*"

NSTH 615.62, p. 615-216 and 615-217, renumber IBEB. through IBEK. (renumbered as IBEB. to IBEM.) as IBEC. through IBES. and add the following:

"IBEB. Other Eutroboralfs which have both:

1. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact,

whichever is shallower; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) either:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; or

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 20 cm or more below the mineral soil surface.

Aquertic Eutroboralfs"

Page 139 and NSTH 615.62, p. 615-228 before item

Page 139, NSTH 615.62, p. 615-229, item ICHH. (Arenic Aridic Haplustalfs) (changed to ICHL. above). Change items 1.a. and 1.b. to 1.b. and 1.c. and add the following as 1.a.:

"a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

Page 139 and NSTH 615.62, p. 615-229. Following item ICHI. (Changed to ICHM. above, Arenic Haplustalfs). Change items ICHM. and ICHN. to ICHO. and ICHP. and add the following:

"ICHM. Other Haplustalfs which have *both*:

1. A calcic horizon with its upper boundary within 100 cm of the mineral

2. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for less than 105 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some part for four tenths or less of the cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for less than 120 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

Calcic Udic Haplustalfs

ICHR. Other Haplustalfs that have a calcic horizon with its upper boundary within 100 cm of the mineral soil surface.

Calcic Haplustalfs"

Page 139 and NSTH 615.62, p. 615-229, following item ICHM. (Changed to ICHT. above) (Udic Haplustalfs). Renumber items 1. and 2. as 2. and 3 and add the following:

"1. A frigid soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for less than 105 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

NSTH 615.62, p. 615-230, Definition of Typic Haplustalfs; Add the following new item 6.a. and renumber items 6.a and 6.b as 6.b and 6.c.:

"a. A frigid soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for 105 or more cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C;"

NSTH 615.62, p. 615-230, Definition of Typic Haplustalfs; Add the following new item 9.a., renumber items 9.a and 9.b as 9.b and 9.c. and add new item 10.:

"a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for less than four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

"10. Do not have a calcic horizon with its upper boundary within 100 cm of the mineral soil surface."

Page 141, NSTH 615.62, p. 615-232 and NSTH 615.90, p. 615-519; Renumber and move item ICCF. (changed to ICCG. salidic Natrustalfs) before item ICCA. (Vertic Natrustalfs) and add the following new items:

"ICCB. Natrustalfs that have *all* of the following:

1. Visible crystals of gypsum or other salts more soluble than gypsum or both within 40 cm of the mineral soil surface; *and*

2. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C; *and*

3. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Leptic Torrertic Natrustalfs

ICCC. Other Natrustalfs that have *both* of the following:

1. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which,

in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C; *and*

2. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Torrertic Natrustalfs

ICCD. Other Natrustalfs which have *both*:

1. In one or more horizons within 75 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time

four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

Aridic Leptic Natrustalfs"

Page 141, NSTH 615.62, p. 615-232 and NSTH 615.90, p. 615-519; Renumber ICCA. through ICCE. as ICCF. through ICCK. and following item ICCE. (changed to ICCK. above) add:

"ICCL. Other Natrustalfs that have visible crystals of gypsum or other salts more soluble than gypsum or both within 40 cm of the mineral soil surface.

Leptic Natrustalfs

ICCM. Other Natrustalfs that have *both* of the following:

1. An exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) in 50 percent or

1. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

2. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

3. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

Aridic Natrustalfs"

Page 141, NSTH 615.62, p. 615-232 and NSTH 615.90, p. 615-519; Renumber items ICCG. and ICCH. as items ICCO. and ICCP.

Page 143, NSTH 615.62 p. 615-233; item ICFK. (Calciorthidic Paleustalfs) (changed to ICFN. Calcidic Paleustalfs); Add new item 1.a. as follows and renumber items 1.a. and 1.b. as 1.b. and 1.c.:

"a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

Page 143, NSTH 615.62 p. 615-233; item ICFL. (Aridic Paleustalfs) (changed to ICFO. Aridic Paleustalfs); Add new item 1. as follows and renumber items 1. and 2. as 2. and 3.:

"1. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

NSTH 615.62, p. 615-234, Definition of Typic Paleustalfs; Add new item 8.a. as follows, renumber items 8.a. and 8.b. as items 8.b. and 8.c., and renumber items 8.d., 9., 10., and 11., as 9.,

a. A clayey or clayey-skeletal particle-size class; *and*

b. A clay increase, in the fine-earth fraction, of either 20 percent or more (absolute) within a vertical distance of 7.5 cm, *or* of 15 percent or more (absolute) within a vertical distance of 2.5 cm.

Palexeralfs"

Page 151, Definition of Palexeralfs (refer to NSTH 615.11, p. 615-19); Replace entire definition with the following:

"Palexeralfs are the Xeralfs that have one of the following:

1. A petrocalcic horizon that has its upper boundary within 150 cm of the mineral soil surface; *or*

2. No densic, lithic, nor paralithic contact within 150 cm of the mineral soil surface, *and* an argillic horizon which has *both*:

a. Within 150 cm of the mineral soil surface, *either*

(1) No clay decrease, with increasing depth, of 20 percent or more (relative) from the maximum clay content; *or*

clay content *and*, below that layer, a clay increase of 3 percent or more (absolute) in the fine-earth fraction; *and*

1. Have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of

NSTH 615.60, p. 615-185. Change item BGD. (changed to CGD.) as follows:

"CGD. Other Udands which have a layer that meets the depth, thickness, and organic-carbon requirements of a melanic epipedon.

Fulvudands"

NSTH 615.60, p. 615-190, definition of Fulvudands; Change item 3. to read as follows:

"3. Do not have a melanic epipedon, but have a layer that meets the depth, thickness, and organic-carbon requirements of a melanic epipedon."

615.148 Rhodic great groups and subgroups

Page 125, item HEH. (changed to IEJ.). Delete entire item and replace with the following:

"IEJ. Other Udalfs that have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodudalfs"

Page 136. After the description of Rhodudalfs, add the

(2) Less than 5 percent (by volume) skeletans on faces of peds in the layer that has a 20 percent lower clay content or, below that layer, a clay increase of less than 3 percent (absolute) in the fine-earth fraction."

Page 138 item HCE. (changed to ICG.). Delete entire item and replace with the following:

"ICG. Other Ustalfs that have in *all* horizons

4. Do not have within 150 cm of the mineral soil surface plinthite forming a continuous phase or constituting one half or more of the volume."

Rhodic Subgroups of Alfisols:

NSTH 615.62, p. 615-225, item IEGH. (change to IEGI., Rhodic Kandiudalfs). Replace with the following:

"IEGI. Other Kandiudalfs that have in *all* horizons in the upper 100 cm of the argillic or

horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Paleudalfs"

NSTH 615.62, p. 615-228, Definition of Typic Paleudalfs. Change item 4. to read as follows:

"4. Do not have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.62, p. 615-231, item ICDI. (Rhodic Kandiustalfs), Replace with the following:

"ICDI. Other Kandiustalfs that have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Kandiustalfs"

NSTH 615.62, p. 615-231, Definition of Typic Kandiustalfs. Change item 6. to read as follows:

"6. Do not have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.62, p. 615-232, item ICEE. (Rhodic Kanhaplustalfs). Replace with the following:

"ICEE. Other Kanhaplustalfs that have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Kanhaplustalfs"

NSTH 615.62, p. 615-232, Definition of Typic Kanhaplustalfs. Change item 5. to read as follows:

"5. Do not have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

Page 143 and NSTH 615.62, p. 615-234, item ICFN. (Changed to ICFQ.), (Rhodic Paleustalfs); Replace with the following:

"ICFQ. Other Paleustalfs that have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Paleustalfs"

NSTH 615.62, p. 615-235, Definition of Typic Paleustalfs. Change item 10. to read as follows:

"10. Do not have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.45, p. 615-129, item CDBH. (changed to DDBH., Humic Rhodic Acroperox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Acroperox"

NSTH 615.45, p. 615-129, item CDBK. (changed to DDBK., Rhodic Acroperox); Replace with the following:

"CDBK. Other Acroperox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.

Rhodic Acroperox"

NSTH 615.62, p. 615-353, Definition of Typic Acroperox; Delete the word "have", add a ":" at the end of the first line, and change item 6. to read as follows:

"6. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less."

NSTH 615.45, p. 615-131, item CDCK. (changed to DDCK., Humic Rhodic Eutroperox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Eutroperox"

NSTH 615.45, p. 615-129, item CDCN. (changed to DDCN., Rhodic Eutroperox); Replace with the following:

"DDCN. Other Eutroperox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.

Rhodic Eutroperox"

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Kandiperox"

NSTH 615.45, p. 615-135, item CDDL. (changed to DDDL.) (Rhodic Kandiperox); Replace with the following:

"DDDL. Other Kandiperox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.

Rhodic Kandiperox"

NSTH 615.62, p. 615-353 and 354, Definition of Typic Haploperox. Add a ":" at the end of the first line and change item 6. to read as follows:

"6. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

[redacted]

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-140, item CEBJ. (changed to DEBJ., Humic Rhodic Acrudox). Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

NSTH 615.45, p. 615-142, item CECN. (changed to DECN., Rhodic Eutrudox); Replace with the following:

"DECN. Other Acrudox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.
Rhodic Eutrudox"

NSTH 615.62, p. 615-354, Definition of Typic Eutrudox. Add a ":" at the end of the first line and change item 7. to read as follows:

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-144, item CEEJ. (changed to DEEJ. Humic Rhodic Hapludox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.
Humic Rhodic Hapludox"

NSTH 615.45, p. 615-144, item CEEM. (changed to DEEM., Rhodic Hapludox). Replace with the following:

"DEEM. Other Hapludox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.
Rhodic Hapludox"

NSTH 615.62, p. 615-355, Definition of Typic Hapludox; Add a ":" at the end of the first line and change item 7. to read as follows:

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-146, item CEDI. (changed to DEDI. Humic Rhodic Kandiudox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.
Humic Rhodic Kandiudox"

NSTH 615.45, p. 615-146, item CEDL. (changed to DEDL. Rhodic Kandiudox); Replace with the following:

"DEDL. Other Kandiudox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.
Rhodic Kandiudox"

NSTH 615.62, p. 615-355, Definition of Typic Kandiudox; Add a ":" at the end of the first line and change item 6. to read as follows:

"6. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-149, item CCBJ. (changed to DCBJ. Humic Rhodic Acrustox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.
Humic Rhodic Acrustox"

NSTH 615.45, p. 615-149, item CCBM. (changed to DCBM. Rhodic Acrustox); Replace with the following:

"DCBM. Other Acrustox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.
Rhodic Acrustox"

NSTH 615.62, p. 615-355 and 356, Definition of Typic Acrustox; Add a ":" at the end of the first line and change item 7. to read as follows:

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-151, item CCCK. (changed to DCCK. Humic Rhodic Eutrustox). Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.
Humic Rhodic Eutrustox"

NSTH 615.45, p. 615-152, item CCCN. (changed to DCCN. Rhodic Eutrustox); Replace with the following:

"DCCN. Other Eutrustox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.
Rhodic Eutrustox"

NSTH 615.62, p. 615-356, Definition of Typic Eutrustox; Add a ":" at the end of the first line and change item 7. to read as follows:

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-153, item CCEJ. (changed to DCEK. Humic Rhodic Haplustox); Replace [illegible] with the following:

percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Haplustox"

NSTH 615.45, p. 615-154, item CCEM. (changed to DCEN. Rhodic Haplustox); Replace with the following:

"DCEN. Other Haplustox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

Page 360, item FCD. (Changed to GCF.); Replace criteria with the following:

"GCF. Other Udults which have *both*:

1. An epipedon that has a color value, moist, of 3 or less throughout; *and*

2. In *all* horizons in the upper 100 cm of the argillic horizon or throughout the [illegible]

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist.

Rhodudults"

Page 369, item FDC. (Changed to GDE.); Replace with the following:

"GDE. Other Ustults which have *both*:

1. An epipedon that has a color value, moist, of 3 or less throughout; *and*

2. In *all* horizons in the upper 100 cm

Rhodic Kandiudults"

NSTH 615.62, p. 615-375, Definition of Typic Kandiudults; Add a ":" at the end of the first line and change item 4. to read as follows:

"4. Have in some or all parts of the upper 100 cm of the argillic or kandic horizon, 50 percent or less colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.62, p. 615-376, item GCDJ. (Changed to GCDK. Rhodic Kanhapludults); Replace with the following:

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Paleudults"

NSTH 615.62, p. 615-378, Definition of Typic Paleudults; Add a ":" at the end of the first line and change item 4. to read as follows:

"4. Have in some or all parts of the upper 100 cm of the argillic horizon, 50 percent or less colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

[redacted]

c. A value dry no more than 1 unit higher than the value moist."

615.149 Vertic and combination "Vertic" subgroups of Fluvents

NSTH 615.62, p. 615-269, renumber items KDFA. through KDFF. as KDFC. through KDFH. and add the following:

"KDFA. Udifluvents which have both:

1. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower; *and*

2. *Either* or both of the following:

a. In one or more horizons within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *or*

b. In one or more horizons within 100 cm of the mineral soil surface, a color value, moist, of 4 or more and either a chroma of 0 or a hue of 5GY, 5G, 5BG, or 5B, and also aquic conditions for some time in most years (or artificial drainage).

Aquertic Udifluvents

KDFB. Other Udifluvents which have one or both of the following:

1. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

2. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Vertic Udifluvents"

NSTH 615.89, p. 615-466, add the following to the definition of Typic Udifluvents:

"5. Do not have either of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower."

Page 192 and NSTH 615.62, p. 615-270. Before item KDCA. (Vertic Ustifluvents) add the following and renumber items KDCA. through KDCH. as KDCC. through KDCJ.:

"KDCA. Ustifluvents which have both:

1. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower; *and*

2. Either or both of the following:

a. In one or more horizons within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *or*

b. In one or more horizons within 150 cm of the mineral soil surface, a color value, moist, of 4 or more and either a chroma of 0 or a hue of 5GY, 5G, 5BG, or 5B, and also aquic conditions for some time in most years (or artificial drainage).

Aquertic Ustifluvents

KDCB. Other Ustifluvents that have *both* of the following:

1. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil

surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C; *and*

2. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Torrertic Ustifluvents"

615.150 Aridic Lithic and Gypsic subgroups of Ustochrepts

Page 225 and NSTH 615.62, p. 615-302 item JDDA. (changed to JDEA. Lithic Ustochrepts) add "Other" at the beginning, renumber as JDEB., add the following item before JDEB., and renumber items JDEB. to JDEK. as JDEC. to JDEL:

"JDEA. Ustochrepts that have:

1. A lithic contact within 50 cm of the mineral soil surface; *and*

2. If neither irrigated nor fallowed to store moisture, *one* of the following:

a. A frigid soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in all parts for four tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is moist in some or all parts for less than 180 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

Aridic Lithic Ustochrepts"

Page 225 and NSTH 615.62, p. 615-302. following item JDDG. (changed to JDEL. above Fluventic Ustochrepts); Add the following item and renumber items JDEL. to JDER. as JDEN. to JDET:

"JDEM. Other Ustochrepts which have a gypsic horizon that has its upper boundary within 100 cm of the mineral soil surface.

Gypsic Ustochrepts"

NSTH 615.62, p. 615-303, Definition of Typic Ustochrepts. Add a ":" at the end of the first line and add item 8. as follows:

"8. Do not have a gypsic horizon that has its upper boundary within 100 cm of the mineral soil surface."

615.151 Combination "Oxyaquic" Subgroups

NSTH 615.62, p. 615-216, following item IBEF. (changed above to IBEH. Aquic Eutroboralfs); Add items IBEI. through IBEL. as follows:

"IBEI. Other Eutroboralfs which have *both*

1. An argillic horizon that:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon; *and*

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Lamellic Oxyaquic Eutroboralfs

IBEJ. Other Eutroboralfs which:

1. Have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick; *and*.

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Oxyaquic Psammentic Eutroboralfs

IBEK. Other Eutroboralfs that have *both*:

1. A sandy or sandy-skeletal particle-size class throughout a layer extending from the mineral soil surface to the top of an argillic horizon at a depth of 50 to 100 cm; *and*

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Arenic Oxyaquic Eutroboralfs

IBEL. Other Eutroboralfs which *both*:

1. Have A glossic horizon; *and*

2. Are saturated with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Glossic Oxyaquic Eutroboralfs"

NSTH 615.62, p. 615-216. Renumber item IBEG. through IBEK. (renumbered above to IBEI. through IBEN.) as IBEM. to IBER.

NSTH 615.60, p. 615-188, following item BBEB. (changed to CBEB. Aquic Vitricryands) add item CBEC. as follows:

"CBEC. Other Vitricryands that are saturated with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Oxyaquic Vitricryands"

NSTH 615.60, p. 615-188, column 2, following item 6.

"7. Are not saturated with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years."

NSTH 615.60, p. 615-188, renumber items BBEC. through BBEF. (renumbered as CBEC. through CBEI.) as CBED. through CBEJ.

NSTH 615.91, p. 615-589, following item BDCA., (Aquic Fragiorthods), add BDCB. as follows:

"BDCB. Other Fragiorthods that:

1. Are saturated with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years; *and*

2. Have, within 200 cm of the mineral soil surface, an argillic or a kandic horizon that has a base saturation of 35 percent or more (by sum of cations) in some part.

Alfic Oxyaquic Fragiorthods"

NSTH 615.91, p. 615-590, following item BDEE., (Aquic Haplorthods); Add items BDEF. and BDEG. as follows:

"BDEF. Other Haplorthods which have:

1. Within 200 cm of the mineral soil surface, an argillic or a kandic horizon that has a base saturation of 35 percent or more (by sum of cations) in some part; *and*

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Alfic Oxyaquic Haplorthods

BDEG. Other Haplorthods which have:

1. Within 200 cm of the mineral soil surface, an argillic or a kandic horizon; *and*

2. Are saturated with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Oxyaquic Ultic Haplorthods"

And renumber BDEF. through BDEK. as BDEH. through BDEM.

615.152 Vermic great groups and subgroups

Page 109, Key to Great Groups, change item IAF. to read as follows:

"IAF. Other Aqualfs that have one or more layers at least 25 cm thick (cumulative) within a depth of 100 cm from the mineral soil surface, which have 50 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts.

Vermaqualfs"

And change items IAF. through IAJ. to IAG. through IAK.

Page 119; Before the section on Boralfs, add the following:

"**Vermaqualfs**

Vermaqualfs are the Aqualfs that have recognizable bioturbation such as filled animal burrows, wormholes, or casts. Bioturbation has not destroyed the argillic horizon. It has been shown that because krotovinas are dense, massive, compact, and stratified, they restrict water movement. Significant amounts of krotovinas in a soil affect soil morphology, soil hydrology, and soil behavior. These soils are known to occur along the coastal plain of Texas as well as other states in the southeastern United States.

Definition

Vermaqualfs are the Aqualfs that:

1. Do not have one or more

2. Have one or more layers at least 25 cm (cumulative) within a depth of 100 cm from the mineral soil surface, which have 50 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts;

3. Do not have a duripan, fragipan, or natric horizon;

4. Have a CEC of more than 16 cmol(+)/kg clay (by 1N NH_4OAC pH 7) and an ECEC of more than 12 cmol(+)/kg clay (sum of bases extracted with 1N

volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts.

Vermic Fragiaqualfs"

Page 239 and NSTH 615.62, p. 615-210, Definition of Typic Fragiaqualfs; After item 3. add the following:

"4. Do not have one or more layers at least 25 cm thick (cumulative) within a depth of 100 cm from the mineral soil surface, which have 25 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts."

Page 236, Key to great groups of Aquepts, following item IAI. (Tropaquepts, changed to JAG. in NSTH 615.60 p. 615-204). Add the following and

a continuous phase or constitutes one half or more of the volume.

8. Have a difference of 5°C or more between mean summer and mean winter soil temperatures either at a depth of 50 cm from the soil surface, or at a densic, lithic, or paralithic contact, whichever is shallower.

Key to subgroups

JAHA. Vermaquepts that have an exchangeable sodium percentage of 7 or more (or a sodium adsorption ratio, SAR, of 6 or more) in one or more subhorizons within 100 cm of the mineral soil surface.

Sodic Vermaquepts

JAHB. Other Vermaquepts.

Typic Vermaquepts

Definition of Typic Vermaquepts

Typic Vermaquepts are the Vermaquepts that do not have an exchangeable sodium percentage of 7 or more (or a sodium adsorption ratio, SAR, of 6 or more) in one or more subhorizons within 100 cm of the mineral soil surface."

615.153 Thapto-Histic Hydraquents

NSTH 615.62, p. 615-266 (Soil Taxonomy, p. 185); Delete item KABA. and add the following:

"KABA. Hydraquents that have a buried Histosol, or a buried histic epipedon, that has its upper boundary within 100 cm of the mineral surface.

Thapto-Histic Hydraquents

KABB. Other Hydraquents.

Typic Hydraquents"

"Definition of Typic Hydraquents

Typic Hydraquents are the Hydraquents that have neither a buried Histosol, nor a buried histic epipedon, that has its upper boundary within 100 cm of the mineral surface."

615.154 "Vitrandic" subgroups of Ustorthents

Page 200 and NSTH 615.62, p. 615-276, NSTH 615-89 p. 615-469 and NSTH 615.99 p. 615-596: Add

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is moist in some or all parts for less than 180 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C; *and*

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, *and*:

(1) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass; *and*

(2) [(Aluminum plus 1/2 iron, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is equal to 30 or more.

Vitritorrandic Ustorthents

KEED. Other Ustorthents that have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and *either*:

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, *and*

(1) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, *and*

(2) [(Aluminum plus 1/2 iron percentages (by ammonium oxalate) times 60] plus the volcanic glass (percent) equal to 30 or more."

615.155 Aquic Calciborolls

NSTH 615.89, p. 615-491; Change item HEFD. to the following:

"HEFD. Other Calciborolls that have, in one or more horizons within 100 cm of the mineral soil

In a vertical cross section of a pedon a lamella appears as a thin horizon and is often called a "band". It actually is an undulating layer and it is not always continuous. The upper and lower boundaries may be wavy and the thickness may vary from one point to another.

Lamellae commonly occur in sandy and sandy-skeletal sediments and less commonly in coarse-loamy, loamy-skeletal and coarse-silty sediments. The texture of the fine-earth in lamellae is mostly loamy sand or sandy loam but the texture is known to range from sand to sandy clay loam, silt loam and clay loam. The content of rock fragments ranges from none to more than 65 percent. Structure is commonly single grained or granular, but in some pedons the layer is massive.

Laboratory data show that, in addition to

some sand grains are devoid of clay and some have only thin clay coatings. The lower part of these lamellae appear very similar to the entire lamella in the upper most part of the lamellae zone. These lamellae are wavy but commonly not as wavy as those in the upper part of the lamellae zone.

The deepest lamellae are commonly very thin. They have a color contrast that is nearly as great as the inner edge of the lamellae in the

percent) if all parts of the eluvial horizon have more than 15 percent clay in the fine earth fraction."

Page 27 column 1, item 2, line 7; change "1 cm" to "0.5 cm".

Page 36 column 1, item 3b., (changed in NSTH 615.69 and 615.63 p. 615-423) after item 3b(1) add new item 3b(2). as follows and renumber items 3b(2) and 3b(3) as 3b(3) and 3b(4):

layer with an overlying eluvial horizon;
or

NSTH 615.62, p. 615-219; Insert the following new item after item IBFE. (Psammentic Glossoboralfs, changed to IBFG. above).

"IBFH. Other Glossoboralfs which have an argillic horizon 35 cm or less thick.
Ochreptic Glossoboralfs"

NSTH 615.62, p. 615-219; Renumber items IBFF. and IBFG. (changed to IBFG. and IBFH.) to IBFI. and IBFJ.

NSTH 615.62, p. 615-219, Definition of Typic Glossoboralfs; Change item 4 to read:

"4. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-219, Definition of Typic Glossoboralfs; add the following new items:

"6. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon; and

7. Have an argillic horizon that is more than 35 cm thick."

NSTH 615.62, p. 615-222; Delete item IEKF. (Psammaquentic Hapludalfs, changed to IEKJ.), renumber item IEKJ. (Anthraquic Hapludalfs, changed to item IEKN.) as IEKJ., and replace item IEKG. (Psammentic Hapludalfs, renumbered as IEKK.) with the following:

"IEKT. Other Hapludalfs that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.
Psammentic Hapludalfs"

NSTH 615.62, p. 615-222; Renumber (and reorder) items IEKH. through IEKO. (renumbered to IEKL. through IEKT.) and item IEKU. (Oxyaquic Hapludalfs added in NSTH 615.89 p. 615-439) as follows:

IEKH. to IEKJ., IEKI. to IEKU., IEKJ. to IEKK., IEKK. to IEKL., IEKL. to IEKM., IEKM. to IEKN., IEKN. to IEKO., and IEKO. to IEKP.; renumber Oxyaquic Hapludalfs as IEKR.

NSTH 615.62, p. 615-222; After (Oxyaquic Hapludalfs, changed to IEKR. above) insert the following;

"IEKS. Other Hapludalfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.
Lamellic Hapludalfs"

NSTH 615.62, p. 615-222; Following items IEKP. and IEKQ. (Glossoboric Hapludalfs, renumbered to IEKV. and IEKW.) add the following new item:

"IEKX. Other Hapludalfs which have an argillic horizon 35 cm or less thick.
Ochreptic Hapludalfs"

NSTH 615.62, p. 615-224; Renumber items IEKR., IEKS., and IEKT. (changed to IEKX., IEKY., and IEKZ.) as IEKY., IEKZ., and IEKZa.

NSTH 615.62, p. 615-224, Definition of Typic Hapludalfs; change item 8. to read:

"8. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-224, Definition of Typic Hapludalfs; Delete "and" at the end of item 10., change "." to a ";" at the end of item 11., and add the following new items;

"12. . Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon; and

13. Have an argillic horizon that is more than 35 cm thick."

NSTH 615.62, p. 615-227, following item IEIG. (Grossarenic Plinthic Paleudalfs, changed to IEII.); Add new item IEIJ. as follows:

"IEIJ. Other Paleudalfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Paleudalfs"

NSTH 615.62, p. 615-227; Renumber and change item IEIG. (changed to IEIJ.) to read:

"IEIK. Other Paleudalfs that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.

Psammentic Paleudalfs"

NSTH 615.62, p. 615-227; Renumber items IEII. through IEIO. (changed to IEIK. through IEIQ.) as IEIL. through IEIR.

NSTH 615.62, p. 615-228, Definition of Typic Paleudalfs; Change item 7. to read:

"7. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-228, Definition of Typic Paleudalfs; Change "." at the end of item 9. to ";" and add the following new item:

"10. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and 7.5 to 20 cm thick, each with an overlying eluvial horizon."

NSTH 615.62, p. 615-229; Before item ICHG. (Psammentic Haplustalfs, changed to ICHK. above) insert the following new item:

"ICHK. Other Haplustalfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Haplustalfs"

NSTH 615.62, p. 615-229; Renumber and change item ICHG. (Psammentic Haplustalfs changed to ICHJ. and then to ICHK. above) to read:

"ICHL. Other Haplustalfs that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.

Psammentic Haplustalfs"

NSTH 615.62, p. 615-229; Renumber items ICHH. and ICHJ. (changed to ICHK. through ICHM. and then to ICHL. through ICHO. above), to ICHM. through ICHP.

NSTH 615.62, p. 615-229; Following item ICHJ. (Aridic Haplustalfs, changed to ICHM. and then to ICHP. above) insert the following new item:

"ICHQ. Other Haplustalfs which have an argillic horizon 35 cm or less thick.

Ochreptic Haplustalfs"

NSTH 615.62, p. 615-229; Renumber items ICHK. through ICHN. (renumbered to ICHN. through ICHQ. and then to ICHP. through ICHU. above) to ICHR. to ICHW.

NSTH 615.62, p. 615-230; Definition of Typic Haplustalfs; change item 5. to read:

"5. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;

NSTH 615.62, p. 615-230; Definition of Typic

layer with an overlying eluvial horizon; *or*

than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62. p. 615-238: Renumber items IDGM..

NSTH 615.62. p. 615-240: Renumber items IDFF.

"JDGH. Other Dystrochrepts which have a cambic horizon composed of lamellae (two or more) within 200 cm of the mineral soil surface.

Lamellic Dystrochrepts"

NSTH 615.62, p. 615-298 and 615-299; Renumber items JDGH. through JDGM. (renumbered as JDHL through JDHO.) as JDHK. through

"JEDG. Other Haplumbrepts that have a sandy particle-size class in all subhorizons throughout the particle-size control section.

Psammentic Haplumbrepts"

NSTH 615.62, p. 615-312, renumber items as follows: JEDG. as JEDH.; JEDH. as JEDI.; JEDI. to JEDE.; JEDJ. (Fluventic Haplumbrepts, changed to JEDK.) to JEDJ.; JEDK. (Entic

NSTH 615.62, p. 615-329, Definition of Typic Argiudolls; Add the following as a new item;

"8. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon."

NSTH 615.91, p. 615-590 Insert the following new item:

"BDEH. Other Haplorthods that have lamellae

Ochreptic Hapludults"

NSTH 615.62, p. 615-372; Insert the following new item:

"GCGG. Other Hapludults which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Hapludults"

NSTH 615.62, p. 615-373, Definition of Typic Hapludults;

"GCEJ. Other Paleudults that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick. Psammentic Paleudults"

NSTH 615.62, p. 615-377; Renumber item GCED.: (Arenic Plinthaquic Paleudults, renumbered to GCEE.) as GCEC. and change item 2.

"2. A sandy or sandy-skeletal particle-size class throughout a layer extending from the from the mineral soil surface to the top of an argillic horizon that is 50 cm or more below the mineral soil surface; *and*"

NSTH 615.62, p. 615-377; Renumber item GCEE. as GCED. and change item GCEE.2., (Aquic Arenic Paleudults, renumbered to item

than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-379, Definition of Typic Paleudults; Add the following new item:

"8. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and

with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Haploxerults"

NSTH 615.62, p. 615-383; Renumber and change item GEBD. to read:

"GEBF. Other Haploxerults that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.

Psammentic Haploxerults"

NSTH 615.62, p. 615-383; Renumber item GEBE. as GEBG., GEBF. as GEBH., and GEBH. as GEBI.

NSTH 615.62, p. 615-384, Definition of Typic Haploxerults; Change item 3. to read:

"3. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-384, Definition of Typic Haploxerults; Add the following new item:

"7. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon."

615.157 Combination "Vertic" Subgroups of Borolls and Udolls

NSTH 615.62, p. 615-317, NSTH 615.90 p. 615-537, NSTH 615.102 p. 615-600, and NSTH 615.127 p. 615-653; Renumber items: HEDB. as HEDK., HEDC. as HEDL., HEDD. as HEDM., HEDE. as HEDN., HEDF. as HEDB., HEDG. as HEDC., HEDH. as HEDG., HEDI. as HEDH., HEDJ. as HEDI., HEDK. as HEDJ., HEDL. through HEDU. as HEDO. through HEDX., and add the following:

"HEDD. Other Argiborolls which have:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand; *and*

2. A udic moisture regime; *and*

3. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Pachic Udertic Argiborolls

HEDE. Other Argiborolls which have both:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand; *and*

2. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Pachic Vertic Argiborolls

HEDF. Other Argiborolls which have:

1. A udic moisture regime; *and*

2. Either:

a. Above the argillic horizon, an albic horizon, or a horizon that has the color values too high for a mollic epipedon and a chroma too high for an albic horizon; *or*

b. A glossic horizon, or interfingering of albic materials into the upper part of the argillic horizon, or skeletans of clean silt and sand covering 50 percent or more of the faces pf peds in the upper

5 cm of the argillic horizon; *and*

3. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Boralfic Udertic Argiborolls"

NSTH 615.62, p. 615-318, item HEDF., (changed to HEDG. above); Change "Ustertic Argiborolls" to "Udertic Argiborolls" and change item. 2. to read as follows:

"2. A udic moisture regime."

NSTH 615.62, p. 615-323 and 324; Renumber items HEGD. through HEGW. as HEHI. through HEGZb. and add the following:

"HEGD. Other Haploborolls which have both:

1. In one or more horizons within 100 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

lithic, or paralithic contact if shallower; *and*

3. A slope of less than 25 percent and a concave shape; *and*

4. A udic moisture regime; *and*

5. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Cumulic Udertic Haploborolls

HEGF. Other Haploborolls which have:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand, and no densic or paralithic contact nor sandy contrasting layer between 40 and 50 cm form the mineral soil surface; *and*

2. An irregular decrease in organic carbon content from a depth of 25 cm below the mineral soil surface to a depth of 125 cm, or to a densic, lithic, or paralithic contact if

[redacted]

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Aquertic Haploborolls"

"HEGE. Other Haploborolls which have:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand, and no densic nor paralithic contact nor sandy contrasting layer between 40 and 50 cm from the mineral soil surface; *and*

3. A slope of less than 25 percent and a concave shape; *and*

4. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Cumulic Vertic Haploborolls

HEGG. Other Haploborolls which have:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of

2. A udic moisture regime; *and*

3. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.
Leptic Vertic Natriborolls

HECB. Other Natriborolls which have:

1. A color value, dry, of 5 or more either in the upper 18 cm of the mollic epipedon, after mixing, or in an Ap

[redacted]

mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.
Pachic Udertic Haploborolls

2. A moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *and*

3. One or both of the following:

a. Cracks within 125 cm

[redacted]

1. A mollic epipedon 40 cm or more thick, of which, of which 50 percent or more of the thickness has a texture finer than loamy fine sand, and no densic or paralithic contact nor sandy contrasting layer between 40 and 50 cm from the mineral soil surface: *and*

2. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.
Torrertic Natriborolls

percent or more (absolute, in the fine-earth fraction) within its upper 7.5 cm.
Abruptic Argiudolls"

NSTH 615.62, p. 615-328, (see 615.89, p. 615-493), change HGCM. (changed to HGCN. above) to HGCO. and add the following:

" HGCL. Other Argiudolls that have an albic horizon that is directly below the mollic epipedon or is a part of the (ochric) epipedon.
Albic Argiudolls"

NSTH 615.89, p. 615-492, Definition of Typic Argiudolls; Add the following:

"6. Do not have an argillic horizon that has a clay increase with depth of 20 percent or more (absolute, in the fine-earth fraction) within its upper 7.5 cm;

or more (or a sodium adsorption ratio of 13 or more) within 100 cm of the mineral soil surface."

NSTH 615.90, p. 615-552, column 2, Definition of Endoaquerts, item 1.; Delete ", or a natric horizon" and add an item 4. as follows:

"4. Do not have a natric horizon nor an exchangeable sodium percentage of 15 percent or more (or a sodium adsorption ratio of 13 or more) within 100 cm of the mineral soil surface."

NSTH 615.90, p. 615-553, column 2, Definition of Epiaquerts, item 1.; Delete ", or a natric horizon" and add an item 4. as follows:

"4. Do not have a natric horizon nor an exchangeable sodium percentage of 15 percent

respective criteria rather than the particle-size control section (defined in chapter 19). Because they have a different control section, these classes are commonly different than the particle-size class defined for the family."

Page 80, column 1: Delete entire section on families and series and replace with the following:

"FAMILIES

In this category, the intent has been to group the soils within a subgroup having similar physical and chemical properties that affect their responses to management and manipulation for use. The responses of comparable phases of all soils in a family are nearly enough the same to meet most of our needs for practical interpretations of such responses. In some cases, soil properties are used in this category without regard to their significance as marks of soil forming

Series

Names of series as a rule are abstract place names. The name usually is taken from a place near the one where the series was first recognized. It may be the name of a town, a county, or some local feature. Some series have coined names. Many of the series names have been carried over from earlier classifications. Some have been in use since 1900. The name of a series carries no meaning to people who have no other source of information about the soils in it."

Page 84, column 2: Delete entire section "Meaning in the names" and replace with the following:

"MEANINGS IN THE NAMES

The Jocity and Youngston series (table 6) are two members of the fine-loamy, mixed, superactive, calcareous, mesic family of Typic

irrigation. Under irrigation, iron chlorosis may be a problem in sensitive plants. If the soil is not irrigated, it can be used only for limited grazing."

Page 88, column 2; Delete entire section "Names of families" and replace with the following:

Each family requires one or more names. The technical family name consists of a series of descriptive terms modifying the subgroup name. For these terms we take the class names that are given later for particle-size class, mineralogy, and so on, in family differentiae (ch. 19). To have consistent nomenclature, the order of descriptive terms in names of families is particle-size class, mineralogy class, cation exchange activity class, calcareous and reaction class, soil temperature class, soil depth class, rupture resistance class, classes of coatings, and classes of cracks.

An alternate family name is the name of one of the series in the family. This is a shorter name intended primarily for use where a long name is inconvenient. This short name is most useful if the series is a common one that is well known in the locality.

Redundancy in names of families should be avoided. Particle-size class and temperature classes should not be used in the family name if they are specified in the subgroup name. Psamments, by definition, all have a sand or loamy sand texture and are in a sandy particle-size class, unless they are ashy. It is therefore redundant to use a particle-size class for Psamments, unless they are ashy. Similarly, all soils in suborders that have the formative element *bor* in the suborder name have frigid (or isofrigid) soil temperature class. Thus, frigid is redundant in the family names of Boralfs, Borohemists, and so on."

Page 383; Delete entire chapter 18 (renumbered as chapter 19 and insert the following new chapter:

"CHAPTER 19
FAMILY AND SERIES DIFFERENTIAE AND NAMES

It was pointed out earlier that families and series serve purposes that are largely pragmatic, that the series name is abstract, and that the technical family name is descriptive. In this chapter, the descriptive terms used in names of families are defined, the control sections to which the terms apply are given, and the criteria, including the taxa in which they are used are indicated. An example of a family is given to show how the family name is derived, and the differences between the two series in that family are pointed out as examples of series differentiae.

FAMILY DIFFERENTIAE FOR MINERAL SOILS AND MINERAL LAYERS OF SOME ORGANIC SOILS

To distinguish families of mineral soils and mineral layers of some organic soils within a subgroup, the following differentiae are used. The components of the family name are listed and defined in the same sequence in which the components appear in the family names.

Particle-size classes
Mineralogy classes
Cation exchange activity classes
Calcareous and reaction classes
Soil temperature classes
Soil depth classes
Rupture resistance classes
Classes of coatings
Classes of cracks

Particle-size classes and their

[redacted]

Definition of particle-size classes and substitutes for classes of mineral soils

The term *particle-size* class is used to characterize the grain-size composition of a whole soil (excluding organic matter and salts more soluble than gypsum), while the term *texture* is used in describing its fine-earth fraction, which consists of particles with a diameter of less than 2.0 mm. Substitutes for particle-size classes are used where normal particle-size classes do not characterize these components adequately.

The particle-size classes of this taxonomy represent a compromise between conventional divisions in pedologic and in engineering classifications. Engineering classifications have set the limit between sand and silt at a diameter of 74 microns, while pedologic classifications have put it at either 50 or 20 microns. Engineering classifications have been based on grain-size percentages by weight in the soil fraction less than 74 mm in diameter, while textural classes in pedologic classifications have been based on percentages by weight in the fraction less than 2.0 mm in diameter. In engineering classifications, the very-fine-sand separate (diameter between 0.05 mm and 0.1 mm) has been subdivided by the 74-micron limit. In defining the particle-size classes for this taxonomy, a similar division has been made, but in a different way. A fine sand or loamy fine sand normally contains an appreciable amount of very fine sand, but the very-fine-sand fraction is mostly coarser than 74 microns. A silty sediment such as loess may also contain an appreciable amount of very fine sand, most of which, however, is finer than 74 microns. So in designing the particle-size classes for this taxonomy, the very fine sand has been allowed to "float." It is included with the sand if the texture (fine-earth fraction) of a soil is sand, loamy fine sand, or coarser. It is, however, treated as silt if the texture is very fine sand, loamy very fine sand, sandy loam, silt loam, or finer.

No single set of particle-size classes seems adequate to serve as family differentiae for all the different kinds of soils. So this taxonomy is providing 2 generalized and 11 more narrowly defined classes, defined later in this chapter. This permits relatively fine distinctions between families of soils for which particle size is important, while providing broader groupings for soils in which narrowly defined particle-size classes would produce undesirable separations. Thus the term clayey is used for some soil families to indicate a clay content of 35 percent (30 percent in Vertisols) or more in specific horizons, while in other families the more narrowly defined terms fine and very fine indicate that these horizons have clay contents either of 35 (30 percent in Vertisols) to 60 percent, or of 60 percent or more, in their fine-earth fraction. The term fine earth refers to particles smaller than 2.0 mm in diameter. The term rock fragments means particles 2.0 mm or more in diameter that are strongly cemented or more resistant to rupture and includes all particles with horizontal dimensions smaller than the size of

a pedon. Cemented fragments 2.0 mm or more in diameter that are less strongly cemented are referred to as pararock fragments, and also includes all particles with horizontal dimensions smaller than the size of a pedon. Most pararock fragments are broken into fragments 2.0 mm or less in diameter during the preparation of samples for particle size analysis and are therefore included with the fine earth in the particle-size classes. However, cinders, pumice and pumice-like fragments are treated as fragments in the substitutes for classes regardless of their rupture resistance class.

There are two situations in which particle-size class names are not used. In one, the name is redundant such as for sandy Psamments and Psammaquents and psammentic subgroups.

that contrast most strongly. The aniso class is considered part of the particle-size class name and is set off by commas after the particle-size name. An example follows: sandy over clayey, aniso, mixed, active Aridic Haplustoll.

Generalized particle-size classes

Two generalized particle-size classes, loamy and clayey, are used with shallow classes (defined below) and soils in arenic, grossarenic, lithic, and pergelic subgroups. The clayey class is used in all strongly contrasting particle-size classes with more than 35 percent clay (30 percent in Vertisols). The loamy particle-size class is used in contrasting classes, where appropriate, to characterize the lower part of the particle-size control section. The generalized classes, where appropriate,

B. For Andisols: Between either the mineral soil surface or the upper boundary of an organic layer with andic soil properties,

size classes listed below), *or* in part of the control section (if that part qualifies as an element in one of the strongly contrasting particle-size classes listed below), *or*

of 30 to 100 percent on undried samples: *and*

a. Have a total of 35 percent or more (by volume) rock and pararock fragments, of which two thirds or more (by volume) are pumice or pumice-like fragments.
Medial-pumiceous

or

b. Have 35 percent or more (by volume) rock fragments.
Medial-skeletal

or

c. Have less than 35 percent (by volume) rock fragments.
Medial

or

4. Have a fine-earth fraction which has andic soil properties, and which has a water content at 1500 kPa tension of 100 percent or more on undried samples: *and*

a. Have a total of 35 percent or more (by volume) rock and pararock fragments, of which two thirds or more (by volume) are pumice or pumice-like fragments.
Hydrous-pumiceous

or

b. Have 35 percent or more (by volume) rock fragments.
Hydrous-skeletal

or

c. Have less than 35 percent (by volume) rock fragments.
Hydrous

or

C. Other mineral soils that have a particle-size class that has (by weighted average) in the thickest part of the control section (if the control section is not in one of the strongly contrasting particle-size classes listed below), *or* in part of the control section (if that part qualifies as an element in one of the strongly contrasting particle-size classes listed below), *or* throughout the control section, a fine-earth component of less than 10 percent (including associated medium and finer pores) of the total volume.
Fragmental

or

[In the following classes "clay" excludes clay size carbonates. Carbonates of clay size are treated as silt. If the ratio of percent water retained at 1500 kPa tension to the percentage of measured clay is 0.25 or less or 0.6 or more in half or more of the particle-size control section or part of the particle-size control section in strongly contrasting classes, then the percentage of clay is estimated with the following formula:

Clay % = 2.5(% water retained at 1500 kPa tension - % organic carbon)]

D. Other mineral soils that meet, in the thickest part of the control section, (if part of the control section has a substitute for particle-size class and is not in one of the strongly contrasting particle-size classes listed below), *or* in part of the control section (if that part qualifies as an element in one of the strongly contrasting particle-size classes listed below), *or* throughout the control section meet one of the following sets of particle-size class criteria:

1. Soils with 35 percent or more (by volume) rock fragments; *and* a fine-earth fraction with a texture of sand or loamy sand, including less than 50 percent (by weight) very fine sand.
Sandy-skeletal

or

2. Other soils with 35 percent or more (by volume) rock fragments; *and* less than 35 percent (by weight) clay.
Loamy-skeletal

or

3. Other soils with 35 percent or more (by volume) rock fragments.
Clayey-skeletal

or

4. Other soils with a texture of sand or loamy sand, including less than 50 percent (by weight) very fine sand in the fine-earth fraction.
Sandy

or

5. Other soils, excluding Vertisols, in a shallow family (defined below), or in a lithic, arenic, grossarenic, or a pergellic subgroup, or the layer is an element in a strongly contrasting particle-size class (listed below) and the layer is the lower element or the other element is a substitute for particle-size class, and has a texture of loamy very fine sand, very fine sand, or a finer texture, including less than 35 percent (by weight) clay in the fine-earth fraction.
Loamy

or

6. Other soils that have in the fraction less than 75 mm in diameter, 15 percent or more (by weight) particles with diameters of 0.1 to 75 mm (fine sand or coarser, including rock fragments up to 7.5 cm in diameter); *and* less than 18 percent (by weight) clay in the fine-earth fraction.
Coarse-loamy

or

7. Other soils that have in the fraction less than 75 mm in diameter, 15 percent or more (by weight) particles with diameters of 0.1 to 75 mm (fine sand or coarser, including rock fragments up to 7.5 cm in diameter); *and* 18 to 35 percent (by weight) clay (Vertisols are excluded).
Fine-loamy

or

8. Other soils that have in the fraction less than 75 mm in diameter, less than 15 percent (by weight) particles with diameters of 0.1 to 75 mm (fine sand or coarser, including rock fragments up to 7.5 cm in diameter); *and* in the fine-earth fraction, less than 18 percent (by weight) clay.
Coarse-silty

or

9. Other soils that have in the fraction less than 75 mm in diameter, less than 15 percent (by weight) particles with diameters of 0.1 to 75 mm (fine sand or coarser, including rock fragments up to 7.5 cm in diameter); *and* in the fine-earth fraction, 18 to 35 percent (by weight) clay (Vertisols are excluded).
Fine-silty

or

10. Other soils in a shallow family (defined below), or in a lithic, arenic, grossarenic, or a pergellic subgroup, or the layer is an element in a strongly contrasting particle-size classes (listed below), with 35 percent or more (by weight) clay (more than 30 percent in Vertisols).

Clayey

or

11. Other soils that have (by weighted average) less than 60 percent (by weight) clay in the fine-earth fraction.

Fine

or

12. Other soils.

Very fine

Strongly contrasting particle-size classes

The purpose of strongly contrasting particle-size classes is to identify changes in pore-size distribution or composition, which are not identified in higher soil categories, and which seriously affect the movement and retention of water and/or nutrients.

The following particle-size or substitute classes are considered strongly contrasting if both parts are 12.5 cm or more thick (including parts not in the particle-size control section; however, substitute class names are used only if the soil materials to which they apply extend 10 cm or more into the upper part of the particle-size control section.), and if the transition zone between the two parts of the particle-size control section is less than

fine-earth fraction in the two parts of the control section.
15. Clayey over loamy-skeletal if there is an absolute difference of 25 percent or more between clay percentages of the fine-earth fraction in the two parts of the control section.
16. Clayey over sandy or sandy-skeletal.
17. Clayey-skeletal over sandy or sandy-skeletal.
18. Coarse-loamy over clayey.
19. Coarse-loamy over fragmental.
20. Coarse-loamy over sandy or sandy-skeletal if the coarse-loamy material contains less than 50 percent fine or coarser sand.
21. Coarse-silty over clayey.
22. Coarse-silty over sandy or sandy-skeletal.
23. Fine-loamy over clayey if there is an absolute difference of 25 percent or more between clay percentages of the fine-earth fraction in the two parts of the control section.
24. Fine-loamy over fragmental.
25. Fine-loamy over sandy or sandy-skeletal.
26. Fine-silty over clayey if there is an absolute difference of 25 percent or more between clay percentages of the fine-earth fraction in the two parts of the control section.
27. Fine-silty over fragmental.
28. Fine-silty over sandy or sandy-skeletal.
29. Hydrous over clayey-skeletal.
30. Hydrous over clayey.
31. Hydrous over fragmental.
32. Hydrous over loamy-skeletal.
33. Hydrous over loamy.
34. Hydrous over sandy or sandy-

Some classes, such as sandy and sandy-skeletal, have been combined in some places in the following list. In those cases the combined name is used as the family class if part of the control section meets the criteria for either class.

1. Ashy over clayey.
2. Ashy over loamy-skeletal.
3. Ashy over loamy.
4. Ashy over medial-skeletal.
5. Ashy over medial if the water content at 1500 kPa tension in dried samples of the fine-earth fraction is 10 percent or less for the ashy materials and 15 percent or more for the medial materials.
6. Ashy over pumiceous or cindery if there is an absolute difference of 20 percent or more between volumes of rock fragments in the two parts of the control section.
7. Ashy over sandy or sandy-skeletal.
8. Ashy-skeletal over fragmental or

f the loamy material contains less than 50 percent fine or coarser sand.
36. Loamy over pumiceous or cindery.
37. Loamy-skeletal over clayey if there is an absolute difference of 25 percent or more between clay percentages of the fine-earth fraction in the two parts of the control section.
38. Loamy-skeletal over fragmental if the volume of the fine-earth fraction is 35 percent or more (absolute) greater in the loamy-skeletal part than in the fragmental part.
39. Loamy-skeletal over sandy or sandy-skeletal if the loamy material has less than 50 percent fine or coarser sand.
40. Medial over ashy if the water content at 1500 kPa tension in dried samples of the fine-earth fraction is 15 percent or more for the medial materials and 10 percent or less for the ashy materials.
41. Medial over clayey-skeletal.
42. Medial over clayey

51. Pumiceous or ashy-pumiceous over medial-skeletal.
52. Pumiceous or ashy-pumiceous over medial.
53. Pumiceous or ashy-pumiceous over sandy or sandy-skeletal.
54. Sandy over clayey.
55. Sandy over loamy if the loamy material contains less than 50 percent fine or coarser sand.
56. Sandy-skeletal over loamy if the loamy material contains less than 50 percent fine or coarser sand.

Mineralogy classes

The mineralogy of soil is known to be useful in making predictions of soil behavior and responses to management. Some mineralogy classes occur or are important only in certain taxa or particle-size classes, and others are important in all particle-size classes. The following key to mineralogy classes is designed to make those distinctions.

Control section for mineralogy classes

The control section for mineralogy classes is the same as that defined for the particle-size classes and their substitutes.

Key to mineralogy classes

4. 18 to 40 percent iron oxide (12.6 to 28 percent Fe) (by dithionite citrate) in the fine-earth fraction.

Ferruginous

or

5. 18 to 40 percent gibbsite in the fine-earth fraction.

Allitic

or

6. More than 50 percent (by weight) kaolinite in the less than 0.002 fraction.

Kaolinitic

7. More than 50 percent (by weight) halloysite in the less than 0.002 fraction.

Halloysitic

or

8. All other properties.

Mixed

B. Other soil layers or horizons, in the mineralogy control section, that have a substitute class that replaces the particle-size class and that:

1. Have a sum of eight times the Si (percent by wt. extracted by acid oxalate) plus two times the Fe (percent by wt. extracted by acid oxalate) of 5 or

3. Any particle-size class, except fragmental, and more than 40 percent (by weight) iron oxide (extractable by dithionite citrate), reported as Fe_2O_3 (or 28 percent reported as Fe), in the fine-earth fraction.

Kaolinitic

or

3. Have more (by weight) smectite (montmorillonite, beidellite, and nontronite) than any other single kind of

or

5. Any particle-size class, except fragmental, and more than 40 percent (by weight) of magnesium-silicate

5. Have more vermiculite than any other single kind of clay mineral.

Vermiculitic

or

polyhedrons may shrink and swell with

A. Terric subgroups of Histosols that have (by

iron is considered to be by far its most important mineralogical characteristic.

Mineralogy classes applied only to limnic subgroups

Limnic materials (defined in chapter 4) with a

B. All other Histosols.

Dysic

Soil temperature classes

The soil temperature classes of Histosols are determined using the same key and definitions

mineralogy control sections for families end at Application of family differentiae

and 180 meters north of the southeast corner of section 24, T. 17 N., R. 4 W.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 100 to more than 150 cm and depth to basalt is more than 150 cm. Rock fragments average less than 10 percent in the particle-size control section. The upper part of the particle-size control section, 5 to 105 cm, has an estimated moist bulk density of 0.75 to 0.90 g/cc, volcanic glass content of 5 to 20 percent, acid-oxalate extractable aluminum plus one-half iron of 1.0 to 2.0 percent, phosphate retention of 85 to 95 percent, and 15 bar water retention of 15 to 20 percent for air dried samples. The upper 2/3 of the control section has less than 4 percent organic carbon in some part. Under forest cover, the mean annual soil temperature is about 10 degrees C. (50 degrees F.) and ranges from 8 to 11 degrees C. The umbric epipedon is 25 to 50 cm thick.

The A horizon has value and chroma of 2 or 3 when rubbed and moist and value and chroma are 2,3, or 4 when dry. This horizon is moderately acid to very strongly acid.

Some pedons have AB and BA horizons.

The 2Bw horizon has hue of 5YR or 7.5YR, value and chroma of 4 through 6 moist, 5 through 8 dry. The apparent field texture averages clay loam, silty clay loam, or silty clay, but in some thin subhorizons it is gravelly or cobbly silty clay loam, gravelly or cobbly clay loam, or gravelly or cobbly silty clay. This horizon is moderately acid to extremely acid.

COMPETING SERIES: These are the Bunker soils. Bunker soils contain 15 to 35 percent rock fragments in the particle-size control section.

GEOGRAPHIC SETTING: Boistfort soils are on stable positions on foothills and mountains. Slopes range from 0 to 65 percent. The soils formed in material weathered from basalt and a component of volcanic ash in the upper part. Elevations range from 30 to 540 meters. These soils are in marine climate with cool wet winters and cool dry summers. Average annual precipitation ranges from 180 to 300 cm. The average January temperature is about 3 degrees F.; average July temperature is about 16 degrees C.; and the average annual temperature is about 10 degrees C. The growing season (-2 degrees C.) is 200 to 240 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Bunker soils and the Astoria, Elochoman, Kapuls, Lates, Lytell, Murnen, and Zenker soils. Astoria soils are in a fine class and are Umbrepts. Elochoman, Lytell, and Zenker soils are in a medial class, in addition Lytell, and Zenker soils average [redacted]

DISTRIBUTION AND EXTENT: Southwestern Washington; series is of moderate extent.

SERIES ESTABLISHED: Grays Harbor County (Grays Harbor County Area), Washington, 1970.

REMARKS: Diagnostic horizons and features recognized in this pedon are an umbric epipedon from the mineral surface (at 5 cm) to 53 cm and a cambic horizon from 53 to 157 cm. The upper 48 cm of the particle-size control section has andic soil properties. The ratio of 15 bar water to clay is less than 1.0 and the CEC is less than 150 meq per 100 g clay due to better than "normal" dispersion in one horizon.

ADDITIONAL DATA: Characterization data are available, pedon numbers 84P0906 and 40A3303.

National Cooperative Soil Survey
U.S.A.

LOCATION BUNKER WA

Established Series
Rev. FG/RFP/RJE/TLA
12/93

BUNKER SERIES

The Bunker series consists of deep, well drained soils formed in colluvium weathered from basalt and a component of volcanic ash in the upper part. These soils are on foothills and mountains. Slopes are 1 to 90 percent. The average annual precipitation is about 230 cm and the average annual temperature is about 10 degrees C.

TAXONOMIC CLASS: Medial over clayey, mixed over isotic, mesic Alic Fulvudands

TYPICAL PEDON: Bunker loam - forested. (Colors are for moist soil unless otherwise stated. All textures are apparent field textures.)

Oi--0 to 3 cm (0 to 1 inch); loose slightly decomposed fir needles, twigs and moss.

Oa--3 to 5 cm (1 to 2 inches); decomposed litter; dark red with many white mycelia.

A--5 to 29 cm (2 to 12 inches); dark reddish brown (5YR 3/3) loam, reddish brown (5YR 4/3) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic and weakly smeary; many roots; 15 percent angular basalt pebbles; moderately acid (pH 5.9); clear wavy boundary. (25 to 36 cm thick)

BA--29 to 47 cm (12 to 19 inches); dark reddish brown (5YR 3/4) gravelly clay loam [redacted]

2Bw2--88 to 134 cm (35 to 53 inches); reddish brown (5YR 4/4) clay loam, reddish brown (5YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic and weakly smeary; many roots; many fine pores; 10 percent angular basalt pebbles; moderately acid (pH 6.0); clear irregular boundary. (Combined thickness of the 2Bw horizon is 50 to 90 cm)

2BC--134 to 156 cm (55 to 62 inches); dark brown (7.5YR 3/4) clay loam, reddish brown (5YR 4/4) dry; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic and weakly smeary; few roots; 10 percent angular basalt pebbles; moderately acid (pH 6.0); clear irregular boundary. (10 to

sandstone or siltstone pararock fragments in the particle-size control section. Murnen soils are in a frigid temperatures class. Swem soils are in a medial class and have grayish iron depletions in the particle-size control section.

DRAINAGE AND PERMEABILITY: Well drained; slow to rapid runoff; moderate permeability.

USE AND VEGETATION: Forested. Bunker soils are used for timber production, watershed, wildlife habitat, and recreation. Vegetation is mainly a Douglas-fir and western hemlock with an understory of western swordfern, Oregon-grape, red huckleberry, and vine maple.

[redacted]

TYPE LOCATION: Lewis County, Washington; on logging road number 5 Weyerhaeuser Company McDonald Tree Farm; approximately 570 meters south, 570 meters west of corner sec. 11, T. 12 N., R. 5 W.

RANGE IN CHARACTERISTICS: The mean annual soil temperature ranges from 8 to 11 degrees C. The depth to fractured bedrock ranges from 100 to more than 150 cm from

extensive.

SERIES ESTABLISHED: Wahkiakum County, Washington, 1976.

REMARKS: Diagnostic horizon and features recognized in this pedon are an umbric epipedon from the mineral surface to 29 cm and a cambic horizon from 29 to 156 cm. The upper 43 cm of the particle-size control section has andic soil properties. Thickness and chroma range outside taxonomic limits for

[redacted]

lower part. They form a polygonal pattern in horizontal cross section (plates 6A and 6B). Plate 6A shows a soil in which the fragipan has an upper boundary at a depth of about 60 cm. Plate 6B shows a horizontal cross section through the fragipan. Pedon 34 is an example of another soil in which the fragipan is a bit deeper. Most commonly, a fragipan has an abrupt or clear upper boundary at a depth of 50 to 100 cm below the original soil surface. Thickness ranges from about 15 to 200 cm, and commonly the lower boundary is gradual or diffuse. A fragipan is virtually free of roots except in the bleached seams and on faces of prisms. It should be noted that in many fragipans the bleached materials are not brittle when moist although, if clayey, they may be hard when dry. Clay films are on the faces of peds and bodies or pore fillings of oriented clay are in the matrix of most fragipans. Fragipans consisting of albic materials commonly do not have bodies of oriented clay.

Most fragipans have very coarse prismatic structure. Some have weak to strong, thick platy or lenticular structure within the prisms. In others, the secondary structure is more nearly weak coarse blocky than platy. Some have transitional structure between platy and blocky. Some fragipans have no secondary structure and some appear to be massive. The spacing of any separations or bleached seams between the structural units, that allow the entry of roots, averages 10 cm or more on the horizontal dimensions.

Genesis

The genesis of fragipans is obscure (Grossman and Carlisle 1969). The formation of the density and brittleness of a fragipan has been variously attributed to physical ripening, the weight of glaciers, permafrost processes, and other events during the Pleistocene. Some of the properties of some fragipans are inherited from buried paleosols. The authors cited in the review however, all consider fragipans to be pedogenic soil horizons, regardless of whether the density and brittleness are pedogenic or not, on the following evidence:

horizons. In most instances the morphology of the fragipan is similar. Fragipans are not known to occur in materials that are calcareous, nor do they underlie horizons with a k, y, or z suffix, even if these horizons are weakly developed. If the fragipans are not soil horizons, the failure to find them under horizons with k, y, or z suffixes would be another remarkable accident. Fragipans form only in soils in which water moves downward through the soil. They are at depths which rarely freeze.

6. If a soil has an E' and a B't horizon, the fragipan may be in the lower argillic horizon or even in the eluvial horizon that separates the two B horizons. Thus, it occurs in otherwise eluvial or illuvial horizons.

7. Fragipans are only known to occur in soils formed under forest vegetation.

The authors believe that the polygonal network of bleached materials is formed by reduction of free iron after water has saturated the cracks. The bleached materials commonly are bounded by a thin zone in which iron has been concentrated. Other things being equal, the structural units are smallest in the finest textured materials. For a given texture, structure tends to be larger if the dry season is short or mild than if it is long or intense. Structural units, with bleached surfaces, are rare or absent in the coarsest textured materials.

If an argillic horizon overlies a fragipan, movement of clay down the faces of structural units usually is indicated by relatively thick clay films.

Examination of interiors of the prisms shows close packing of the mineral grains and bodies of oriented clay. The close packing is consistent with the high bulk density of the fragipan relative to the density of the overlying horizons.

The hardness of the fragipan when dry is largely attributed to the close packing and to binding by clay. However, binding by clay alone does not account for the brittleness of

separated prisms. At this time the evidence about the cause of the brittleness is conflicting.

Where a fragipan formed in till, its relatively high bulk density may be attributed partly to the weight of the glaciers, desiccation processes (physical ripening), or to consolidation within a layer of permafrost. Yet, many if not all of the fragipans seem to reflect the influence of other factors. One factor is presumed to be pressure generated by the very slight shrinking and swelling. When dry, a pan normally has very fine cracks between the prisms, and very fine sand, silt, and clay might be washed into these cracks when the dry season ends. Roots growing along the sides of the prisms add to the bulk. Then, when the pan is remoistened, it swells very slightly. The force of swelling, however, is opposed by the materials that have moved into the cracks between the prisms and by the weight of the soil above. The internal pressure thus generated may be responsible for part of the compaction. A second factor is the inertness of the pan. Swelling and shrinking produce little soil movement. Soil fauna seem to be absent, and roots, restricted to the bleached zones between the prisms, are mostly oriented vertically and do not lift the soil as they grow. The pressure generated by the growth of the woody tree roots is lateral, not vertical. The common flattened shape of the roots attests to the pressure. Freezing and thawing are also minimal. Under the native vegetation it is doubtful that many fragipans ever freeze because of their depth and because they are insulated by the O horizons and by snow.

Significance to soil classification

Any continuous horizon that impedes movement of water and growth of roots is important to soil classification--particularly for interpretations of soils for plant growth and for engineering manipulations. Water stands above the pan in a level soil and moves laterally along the top of the pan if the soil is sloping. Even though the processes that produce the fragipans are imperfectly known, these pans are restricted in their climatic range and the natural vegetation and are believed to be genetic.

Identification

First, a fragipan has a combination of properties that restrict the penetration of roots and water from 60 percent or more of the volume of the horizon. Roots are restricted except in nearly vertical zones that form the boundaries between very coarse structural units. The structural units are commonly polyhedral in horizontal cross section and average 10 cm or more across. Material within the structural units is massive, platy, or has weak blocky structure, a firm or firmer consistence, and a brittle manner of failure at or near field capacity. Some fragipans are massive and are restrictive throughout the horizon.

Second, a fragipan has evidence of pedogenesis, in addition to density and brittleness. This evidence, in the matrix, on faces of peds, or in seams, is in the form of bodies of oriented clay, clay films, albic materials, and/or both redoxomorphic features and soil structure. The evidence of pedogenesis is needed to separate the fragipan from dense parent materials (densic materials) such as dense till and volcanic mudflow material.

Third, a fragipan must have a minimum thickness. A thickness of 15 cm or more is thought to be thick enough to impart the interpretations for plant growth and for engineering manipulations and to separate the fragipan from plow pans or other compacted surface or near surface layers.

Fourth, air-dry fragments of the natural soil fabric, 5 to 10 cm in diameter, from more than 50 percent of the horizon slake when they are submerged in water. This property separates fragipans from duripans and other cemented horizons.

Pedon 34 illustrates a soil that has a fragipan below an argillic horizon. The pan is relatively deep and has its upper boundary at a depth of about 94 cm and its lower boundary at about 150 cm.

Pedon 35 illustrates a wet soil in which a fragipan lies below an argillic horizon. In this soil there is lithologic discontinuity in the parent materials at a depth of 53 cm. The upper mantle is presumed to be Wisconsinan loess. The fragipan developed in the surface horizons of a very old soil that developed in coastal plain sediments. It is very common that a fragipan develops in the former surface horizons of these buried soils, if the burial is not more than about 80 cm.

Soils in the United States that have a small amount of plinthite normally are brittle in at least some parts of the horizons that contain the plinthite. Some of these horizons meet the requirements for a fragipan but, in addition have the plinthite. At this stage of knowledge, it is not clear that such horizons should be considered fragipans, but where they are at depths comparable to those of fragipans in other soils, the effects on plants and on engineering uses of the soils are the same. For pragmatic reasons, therefore, such horizons that have an upper boundary within a depth of 100 cm below the mineral soil surface, are considered fragipans.

Summary of properties

To be identified as a fragipan a layer must have all of the following characteristics:

1. The layer is 15 cm or more thick; *and*

2. It has evidence of pedogenesis within the horizon or, at a minimum, on the faces of structural units; *and*

3. It has very coarse prismatic, columnar, or blocky structure of any grade, has weak structure of any size, or is massive. Separations between structural units that allow roots to enter have an average spacing of 10 cm or more on the horizontal dimensions; *and*

4. Air-dry fragments of the natural soil fabric, 5 to 10 cm in diameter, from more than 50 percent of the horizon slake when they are submerged in water; *and*

5. It has, in 60 percent or more of the volume, a firm or firmer consistence, a brittle manner of failure at or near field capacity, and roots virtually absent."

Page 49; Following the section on "Durinodes", insert the following:

"Fragic Soil Properties

Fragic soil properties are similar to the essential properties of the *fragipan*. They have neither the layer thickness nor volume requirements of the fragipan. Fragic soil

properties are in subsurface horizons, although they can be at or near the surface in truncated soils. Aggregates with fragic soil properties have a firm or firmer consistence and a brittle manner of failure when soil water is at or near field capacity. Air-dry fragments of the natural fabric, 5 to 10 cm in diameter slake

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.
Aeric Fragic Epiaqualfs

IAJG. Other Epiaqualfs that have fragic soil properties;

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick; and
Fragic Epiaqualfs"

NSTH 615.89, p. 615-431; Following item 5. of the definition of Typic Epiaqualfs add item 6. as follows:

"6. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.62, p. 615-211; Following item IAFB.

more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.
Aeric Fragic Glossaqualfs

IAGD. Other Glossaqualfs that have fragic soil properties;

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick; and
Fragic Glossaqualfs"

NSTH 615.62, p. 615-211; Following item 3. of the definition of Typic Glossaqualfs add item 4. as follows:

"4. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.38 p. 615-59 definition of Kandiaqualfs; In item 1. delete final word "and", in item 2 delete word "fragipan", add final word "and", and add new item 3. to read:

"3. Do not have a fragipan with its upper

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface; and"

Page 112, column 1, line 2 after "fragipan" add:

" with its upper boundary within 100 cm of the mineral soil surface"

Page 119, Change item HBB. (changed to IBB) to read:

"IBB. Other Boralfs that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiboralfs"

Page 122, column 2, line 35; Change item 1. to read:

"1. Have, with its upper boundary within 100 cm of the mineral soil surface, a fragipan in or below the argillic horizon;"

NSTH 615.62, p 615-217, following item IBED. (Aquic Arenic Eutroboralfs, changed to IBEF. above); Add the following new item and renumber items IBEG. through IBEM. as IBEH. through IBEN.:

"IBEG. Other Eutroboralfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Eutroboralfs"

NSTH 615.89, p 615-435, following item IBEG. (Oxyaquic Eutroboralfs, changed to IBEN. above); Add the following new item and renumber items IBEN. through IBET. as IBEP. through IBEV.:

"IBEO. Other Eutroboralfs that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Eutroboralfs"

NSTH 615.62, p. 615-217; Following item 7. of the definition of Typic Eutroboralfs add item 8. as follows:

"8. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.62, p 615-218, following item IBFC. (Vitrandic Glossoboralfs); Add the following new item and renumber items IBFD. and IBFE. as IBFE. and IBFF.:

"IBFD. Other Glossoboralfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Glossoboralfs"

NSTH 615.89, p 615-435, following item IBFE. (Oxyaquic Glossoboralfs changed to IBFF. above); Add the following new item IBFG. and renumber items IBFF. through IBFJ. as IBFH. through IBFL.:

"IBFG. Other Glossoboralfs that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Glossoboralfs"

NSTH 615.62, p. 615-219; Following item 5. of the definition of Typic Glossoboralfs add item 6. as follows:

"6. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

Page 125; Change items HEE. AND HEF. (changed to IED. and IEF.) to read:

"IED. Other Udalfs that have a glossic horizon and have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fraglossudalfs

IEF. Other Udalfs that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiudalfs"

Page 126, column 2, line 22; Change item 1. to read:

"1. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.47, p 615-161; Change item 2. to read:

"2. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

new items IEKJ. and IEKK. and renumber items IEKJ. through IEKR. (Oxyaquic Hapludalfs) as IEKL. through IEKT.:

"IEKJ. Other Hapludalfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

NSTH 615.62, p 615-226, following item IEIA. (Vertic Paleudalfs); Add the following new item IEIC. and renumber items IEIC. through IEIH. (Oxyaquic Paleudalfs) as IEID. through IEII.:

"IEIC. Other Paleudalfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Paleudalfs"

NSTH 615.89, p 615-442, following item IEIG. (Oxyaquic Paleudalfs changed to IEIH. above): Add the

2. Do not have a duripan nor a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.62, p 615-238, following item IDGF. (Vitrandic Haploxeralfs, changed to IDGG.); Add the following new item IDGH. and renumber items IDGH. through IDGJ. as IDGI. through IEIK.:

"IDGH. Other Haploxeralfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil

thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Palexeralfs"

"1. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.89, p. 615-476, following item JAJD.; Add new item JAJD. and renumber items JAJD. through JAJH. to JAJE. through JAJI.:

"JAJD. Other Endoaquepts that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Endoaquepts"

NSTH 615.89 p. 615-477 column 2, line 29; Change item 1. to read:

"1. Do not have a fragipan with its upper

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions in most years (or artificial drainage).

Fragiaquic Dystrochrepts"

NSTH 615.89, p 615-481, following item JDHI. (Oxyaquic Dystrochrepts changed to JDHJ. above); Add the following new item JDHK. and renumber items JDHK. through JDHP. as JDHL. through JDHQ.:

"JDHK. Other Dystrochrepts that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Eutrochrepts"

NSTH 615.89, p. 615-482, column 2, following item 4. (definition of Typic Eutrochrepts); Add item 5. as follows:

"5. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.62, p 615-304, following item JDEH. (Vitrandic Xerochrepts, changed to JDFI.); Add new item JDFJ. and renumber items JDFJ. through JDFM. as JDFK. through

"BAC. Other Aquods that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiaquods"

NSTH 615.91, p. 615-580, column 2; Change item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-581, column 1; Change item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-581, column 2, line 5; Change item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-582, column 1; Change item 1. to read:

"1. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-582, column 2; Change item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-585; Change item BCC. to read:

"BCC. Other Humods that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragihumods"

NSTH 615.91, p. 615-586, column 1, line 31; Change item 1. to read:

"1. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-586, column 2, line 3; Change item 1. to read:

"1. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p 615-590, following item BDEB. (Lithic Haplorthods); Add new item BDEC. and renumber items BDEC. through BDEF. as BDED. through BDEG.:

"BDEC. Other Haplorthods that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more horizons within 75 cm of the mineral soil surface, redoximorphic features, and also aquic conditions for some time in most years (or artificial drainage).

Fragiaquic Haplorthods"

NSTH 615.91, p 615-590, following item BDEF. (Oxyaquic Haplorthods changed to BDEG. above); Add new item BDEH. and renumber items BDEG. through BDEK. as BDEI. through BDEN.:

"BDEH. Other Haplorthods that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Haplorthods"

NSTH 615.91, p. 615-590, column 2, following item 6. (definition of Typic Haplorthods); Add item 7. as follows:

"7. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.89, p. 615-508; Following item GAHA. add

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick; and

Fragic Episaquults"

NSTH 615.89, p. 615-508; Following item 3. of the definition of Typic Epiaquults add item 4. as follows:

"4. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

Page 351; Change item FAB. (changed to GAB.) to read:

"GAB. Other Aquults that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiaquults"

Page 351, column 2, line 56; After the word "fragipan" add:

" with its upper boundary within 100 cm of the mineral soil surface"

Page 352, column 1, line 18; After the word "fragipan" add:

" with its upper boundary within 100 cm of the mineral soil surface"

NSTH 615.38 p. 615-78; Change item 5. to read:

"5. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.38 p. 615-79; Change item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 353, column 1, line 9, item 1. (rev in NSTH 615.38 p. 615-80); Change item 1. to read as follows, add new item 2., and renumber items 2. through 5. as 3. through 6.:

"1. Do not have a kandic horizon;

2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 353, column 2, line 38, item 1. (rev in NSTH 615.38 p. 615-80); Change item 1. to read as follows, add new item 2., and renumber items 2. and 3. as 3. and 4.:

"1. Do not have a kandic horizon;

2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 355, column 2, line 14; Revise item 2. as follows:

"2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 360 and NSTH 615.38 p. 615-85; Change item FCA. (changed to GCB.) to read:

"GCB. Other Udults that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiudults"

NSTH 615.38 p. 615-87; Rewrite item 5. as follows:

"5. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface."

NSTH 615.38 p. 615-89; Rewrite item 4. as follows:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface."

Page 360, column 2; Rewrite the first sentence of the description of Fragiudults to read:

"These are Udults that have a fragipan with its upper boundary within 100 cm of the mineral soil surface."

Page 361, column 1; Rewrite item a.(1) of the description of Typic Fragiudults to read:

"(1) Have a fragipan with its upper boundary within 100 cm of the mineral soil surface; and"

Page 362, column 2, line 25; Revise item 1. and add new item 2. as follows and renumber items 2. through 5 as 3. through 6.:

"1. Do not have a Kandic horizon;

2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.62, p 615-372, following item GCGC. (Vertic Hapludults); Add new item GCGD. and renumber items GCGD. through GCGG. (Aquic Hapludults, renumbered above) as GCGE. through GCGF.:

"GCGD. Other Hapludults that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more layers within 75 cm of the mineral soil surface, redox *depletions* with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

Fragiaquic Hapludults"

NSTH 615.62, p 615-375, following item GCDK. (Aquic Hapludults, renumbered above as GCGF.); add new item GCGG. and renumber items GCGG. through GCGM., to GCGH. to GCGO.:

"GCGG. Other Hapludults that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Hapludults"

NSTH 615.62, p. 615-373, column 1; Following item 8. (definition of Typic Hapludults); Add item 9. as follows:

"9. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.62, p 615-375, following item GCDA. (Lithic Kanhapludults); Add new item GCDB. and renumber items GCDB. through GCDG. (Aquic Kanhapludults) as GCDC. through GCDH.:

"GCDB. Other Kanhapludults that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

Fragiaquic Paleudults"

NSTH 615.62, p 615-378, item GCEO. (Fragic Paleudults renumbered as GCEQ.); Revise and renumber as follows, and renumber items GCEJ to GCEN. (Plinthic Paleudults renumbered as GCEP.), as GCEK. to GCES.:

"GCEJ. Other Paleudults that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; or

NSTH 615.62, p. 615-318, Revise items HEDJ.2. (Pachic Udic Argiborolls, changed to HEDO.2. above) as follows:

"2. A udic moisture regime."

NSTH 615.62, p. 615-319, Revise items HEDP. (Udic Argiborolls, changed to HEDV. above) as follows:

"HEDV. Other Argiborolls that have a udic moisture regime."

NSTH 615.62, p. 615-319, Delete part 6.b. of items 6. (Definition of Typic Argiborolls) and add an item 9. as follows:

"9. Do not have a udic moisture regime."

NSTH 615.62, p. 615-323, Revise items HEGD.1. (Udertic Haploborolls, changed to HEGI.1. above) as follows:

"1. A udic moisture regime; *and*"

NSTH 615.62, p. 615-323, Revise items HEGH.4.

"HEED. Other Vermiborolls that have a udic moisture regime."

NSTH 615.62, p. 615-327, Delete part 2.b. of items 6. (Definition of Typic Vermiborolls) and add an item 4. as follows:

"4. Do not have a udic moisture regime."

615 162 Corrections and Clarifications

Editorial changes and corrections of typographical and grammatical errors are made throughout the text to clarify the intent of the criteria.

NSTH 615.127, p. 615-652,

Page 28, Natric horizon item 1.b.; Revise as follows:

"b. Both, blocky structure and eluvial materials, which contain uncoated silt or sand grains, and extend more than 2.5 cm into the horizon; and"